16 SEPTEMBER 19

NINEPENCE

ELECTRICAL TIMES

BICC

CABLES for TELECOMMUNICATIONS

The B.B.C. television studios at Lime Grove provide an example of large-scale use of BICC P.V.C. sheathed coaxial cables. A comprehensive colour-coded network distributes specialised wave-forms for the cameras.

Throughout the World BICC products—from television masts to winding wires—are providing vital telecommunication links.

BRITISH INSULATED CALLENDER'S CABLES LIMITED
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INTRODUCE

A TRANSFORMER OF THE FUTURE

DRY TYPE

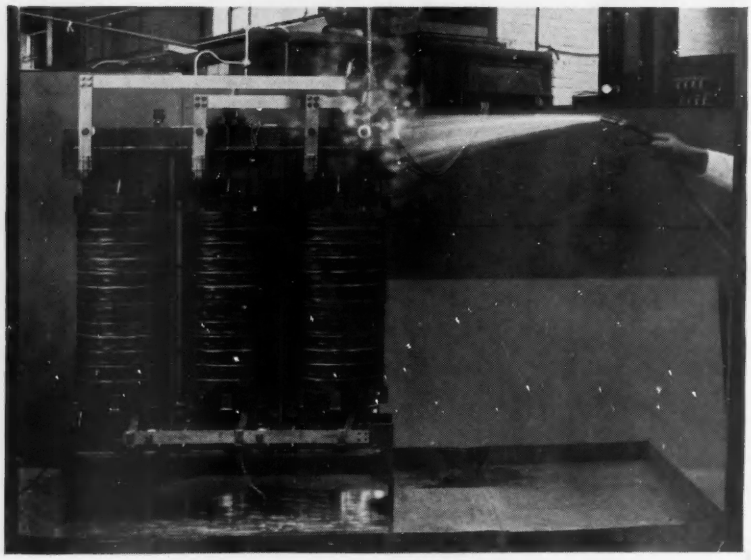
AIR COOLED

DISTRIBUTION TRANSFORMERS

for Sub-Station Distribution and Power Station Auxiliary Service up to 11 kV.

WITH ALL SILICONE IMPREGNATED INSULATION USING ONLY

CLASS H materials



Water Spray Test at Full Voltage on
A 500 kVA., 11 kV. T.W. Transformer (A.N. Cooling)

THE WATER TEST
PROVING THAT
CLASS H INSULATION
IS
MOISTURE REPELLANT

OPERATING TEMPERATURE
180° C

NO FIRE RISK

SMALL COMPACT DESIGN

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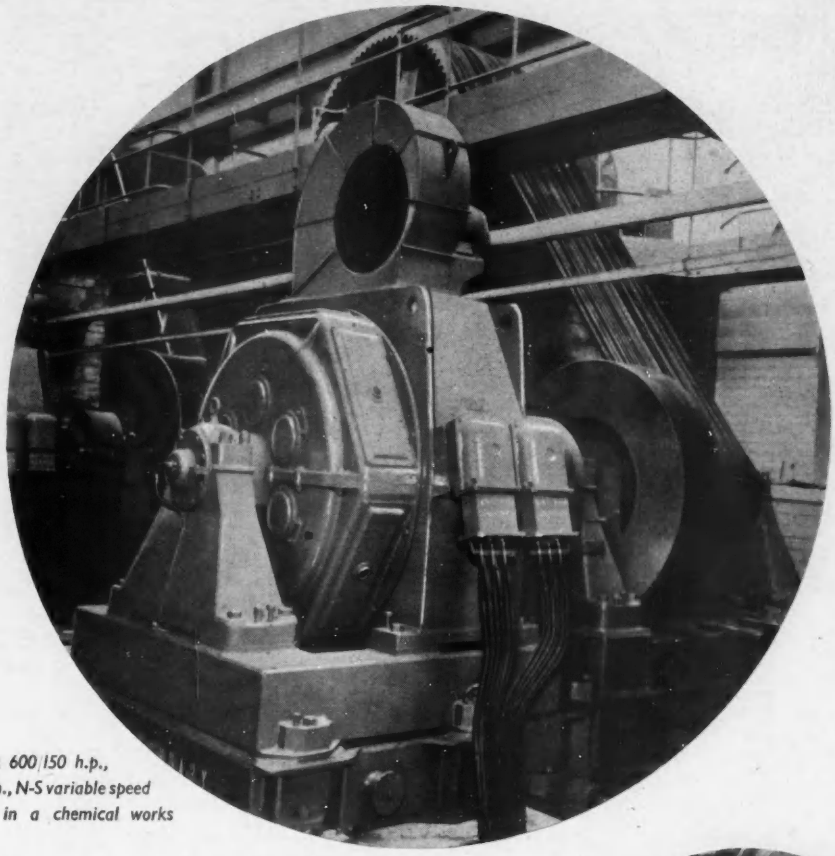
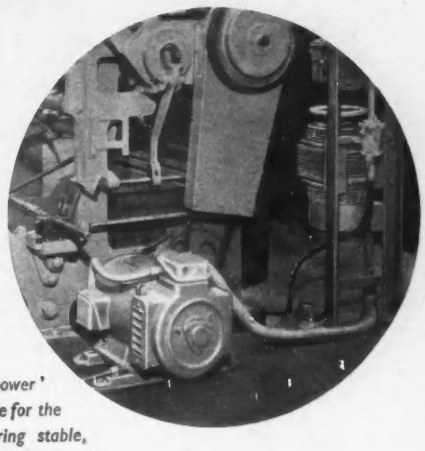


One of eight 600/150 h.p., 720/180 r.p.m., N-S variable speed a.c. motors in a chemical works

L.S.E. MOTORS are in service in all the best circles—large and small



An example of the N-S 'small power' standard range (1-9 h.p.), suitable for the majority of applications requiring stable, stepless speed control and available from stock.

LAURENCE, SCOTT & ELECTROMOTORS

LIMITED

NORWICH, MANCHESTER LONDON & BRANCHES

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Exhibition of Street Lighting Apparatus and Equipment. Eastbourne. Sept. 14th—17th

30-FOOT ADASTRA POLE NESTED FOR TRANSPORT

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★MINIMUM TRANSPORT COSTS
★MINIMUM ERECTION COSTS
★MINIMUM STORAGE COSTS
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In telecommunication, power transmission, lighting, and as radio masts and flagstaffs—in fact wherever poles are called for, *'Adastra' is the logical answer. It is not only for their great service to weight ratio, or even for the fact that they require no maintenance, that they are specified. Low installation costs, easy transport and handling, even over the most intractable terrain, and the remarkable speed with which they are assembled and erected, make them always the soundest and often the only *possible* specification. May we send you a brochure illustrating the wide range of 'Adastra' poles and fittings?

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CONSTRUCTORS GROUP

ANNOUNCEMENT

HECLA ELECTRICS PTY. LTD.,
696-710 Chapel Street, South Yarra,
Victoria, Australia.

who have applied for patents in Australia, Gt. Britain and U.S.A. for "Improvements relating to Electric Irons" (steam ventilated sole and thermostat), desire to secure the commercial exploitation of these inventions in Gt. Britain by sale of the patents when granted.

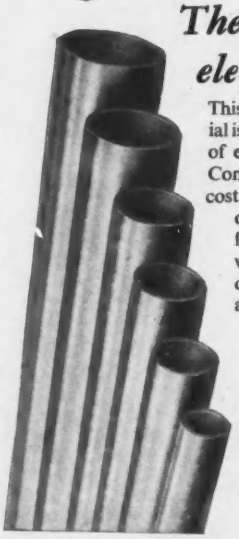
Please reply in first instance to:

GILL, JENNINGS & EVERY
Chartered Patent Agents
51-52 Chancery Lane, London, W.C.2

E. P. Bennett, a director of the vendor Company, is available at the above address to discuss terms, describe and demonstrate the finished product by appointment.

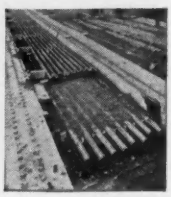
KEY Fibre Conduit

The Key to efficient electrical installations



This non-metallic, pitch impregnated material is now being widely used for the protection of electrical cables everywhere. Key Fibre Conduit is easy to handle, economical in cost and eliminates any electrolytic action on the cable and is recognised as ideal for the purpose. The material is lightweight in character and bends present no difficulty. Technical advice and assistance and quotations—on application.

Key Fibre Conduit is now available in two wall thicknesses-one for laying in concrete and the other for laying direct in the ground.



Export enquiries are invited for bulk supplies against payment in Sterling. New illustrated folder gladly supplied on request together with details of the greatly reduced prices available as a result of home production.

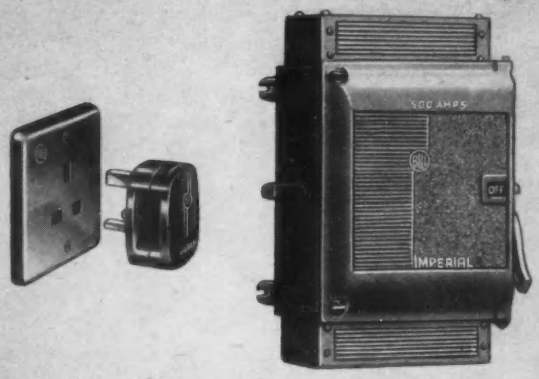
The illustration above shows Key Fibre Conduit laid on a bridge by Westminster Electric Supply Corporation Ltd.—45 years ago.

THE KEY ENGINEERING COMPANY LIMITED

4 Newgate Street, London, E.C.1. *Tel:* City 1185-6-7
Telegrams: "Keypoint, Cannon, London".
Also at: Elevator Road, Trafford Park, Manchester, 17.

BILL — YOU CANNOT BUY BETTER GEAR

You cannot buy better gear



BILL COMPLETE RANGE
13 AMP SOCKET OUTLET TO 500 AMP FUSE SWITCH

★ SOCKET OUTLETS
★ COOKER SWITCHES
★ DISTRIBUTION BOARDS
★ SWITCHES AND SWITCH FUSES
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ASTON LANE · PERRY BARR
BIRMINGHAM·20

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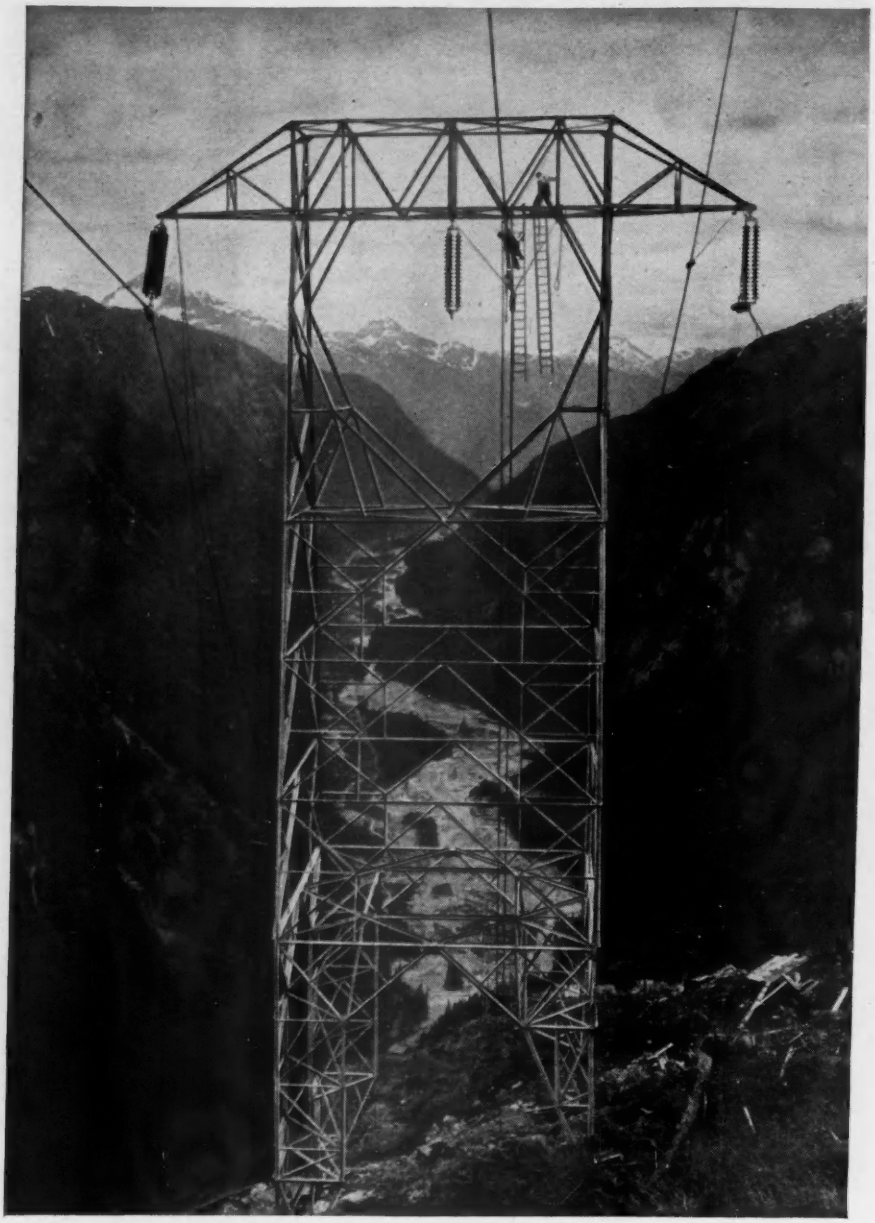
aluminium adventure



power climbs over A PASS

High above the steep sides of the Kemano valley, British Columbia, engineers handle aluminium cable, steel reinforced, 2.26 ins. in diameter—the largest ever made.

This unique transmission line, designed to withstand heavy icing loads, carries the 300,000 volt output of the Kemano underground power station across fifty miles of rugged terrain and over the 5,300 ft. Kildala Pass. To mountain sites inaccessible to all other forms of transport, helicopters have flown-in materials and equipment for the transmission towers which take the power over the pass to Kitimat.

There, on the shores of the Douglas Channel, the great new smelter of Aluminum Company of Canada Ltd. is now in operation. When fully developed it will be capable of producing 500,000 metric tons of aluminium a year, and will play an important part in making aluminium and its alloys ever more abundantly useful.

Aluminium Union Limited

(Incorporated in Canada)

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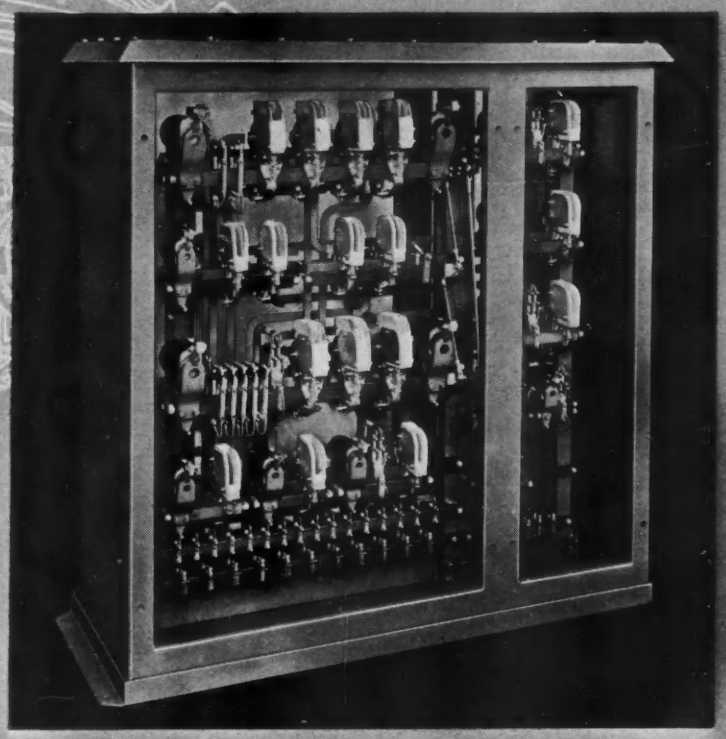
PRINCIPAL BRITISH COMMONWEALTH DISTRIBUTOR OF ALUMINIUM

CONTACTOR SWITCHGEAR LTD
WOLVERHAMPTON
ENGLAND

Contactor Control Gear



For Cranes

The adaptability of CONTACTOR SWITCHGEAR LTD. equipment to crane service is typified by this illustration of a hoist motion contactor panel supplied for an overhead crane. The panel is rated at 35 H.P. 440 volts. D.C. and operating under control of a master controller also made by CONTACTOR SWITCHGEAR LTD. provides six steps of series hoisting, seven steps of potentiometer lowering and dynamic braking.

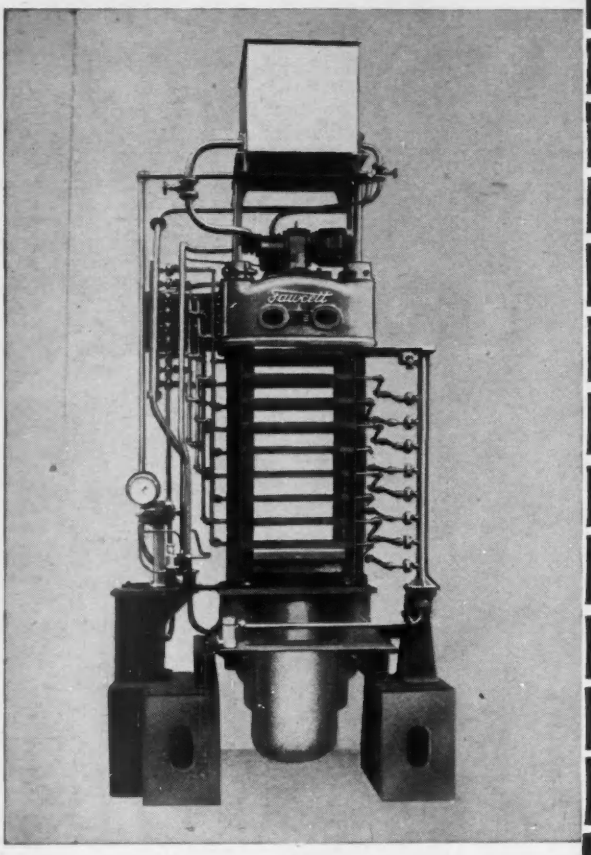
We shall be pleased to quote to your particular requirements for contactor gear applied to any form of crane duty.

CONTACTOR SWITCHGEAR LTD
BLAKENHALL WOLVERHAMPTON ENGLAND
Telephone: Wolverhampton 25111 (5 lines) *Telegrams:* TACTORGEAR Wolverhampton

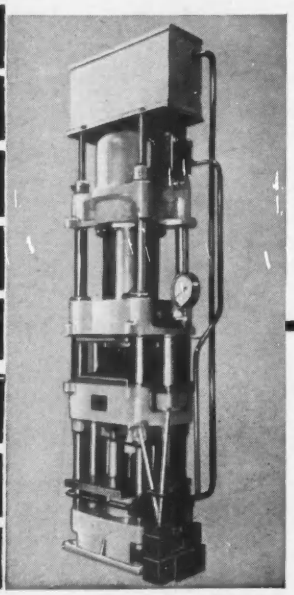
have you a pressing problem?

Then a hydraulic press from our wide range will probably solve it. If, however, it is a very unusual problem, Fawcett designers will gladly co-operate to produce a machine that will economically, yet efficiently, overcome it. For nearly two hundred years we have served industry in a whole-hearted attempt to cut production costs and increase efficiency. Methods change, new materials are developed, but the Company of Fawcett, Preston is always in step.

Fawcett EST 1756 HYDRAULIC PRESSES



This 500-ton up-stroking multi-platen Press has a self-contained pump and oil reservoir mounted on top. Platens are arranged for alternate steam heating and water cooling.



A typical Fawcett hydraulically operated, down-stroking, 100-ton plastic moulding press.

Special presses designed to suit individual requirements

FAWCETT, PRESTON & CO LTD BROMBOROUGH, CHESHIRE *PHONE: ROCKFERRY 2201 (5 LINES)*

P 4623

MANCHESTER ROYAL EXCHANGE - *Photograph by permission of Manchester Evening News*

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Messrs. BRADSHAW, GASS AND HOPE
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Electrical Contractors
E. M. EVANS & CO. LTD.
MANCHESTER

Within the last 40 years, The Manchester Royal Exchange has carried out major building works. Between 1914 and 1921 extensions were made to the Third Exchange, which was erected in 1874. On the night of December 22nd, 1940, the Exchange was one of the many buildings severely damaged through enemy air attack, and in June 1947 work commenced on reconstruction of this important building.

On November 17th, 1953, on the completion of the work, Her Royal Highness The Princess Margaret graciously performed the re-opening ceremony.

Glovers, who were established in 1868, supplied the Rubber and Paper Insulated Cables for the electrical power installations. We are proud to have been associated in the reconstruction of this imposing building.

W. T. GLOVER & CO. LTD.
MEMBERS OF THE C·M·A
TRAFFORD PARK MANCHESTER 17
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BY APPOINTMENT
MAKERS OF ELECTRIC CABLES TO THE LATE KING GEORGE VI

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OSMASTON STREET, NOTTINGHAM

Boiling Plate

850w—6" diameter
SOLID PLATE
EMBEDDED ELEMENT
Volts—200/10 and
230/50

Guessing can be dangerous!

Take no chances-use

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They're lively lads at Lorival...

Modern plastic moulding methods have been applied by Lorival to hard rubber mouldings. Exide leave it to Lorival—so can you.

Among the special features of the new Silver Exide car battery, the high quality hard rubber container plays an important part with its excellent electrical and acid-resisting qualities. The first-class appearance of the container represents a new standard of hard rubber moulding technique. The Porvic microporous separators fitted between the plates are another important factor in this long-life Exide Battery.

Lorival make Silver Exide hard rubber containers, Porvic separators, the hard rubber cell lids and polystyrene vent plugs.

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J. & P. ALUMINIUM SHEATHED CABLES

British Patent Numbers 627815 and 627793

are being installed in

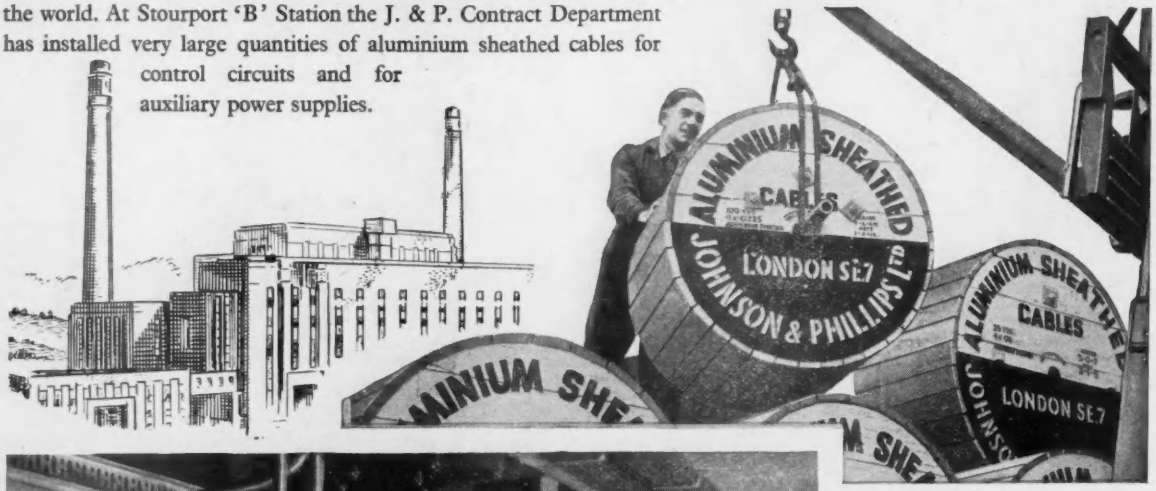
B.E.A Power Stations

including

STOURPORT 'B' **CARMARTHEN BAY**

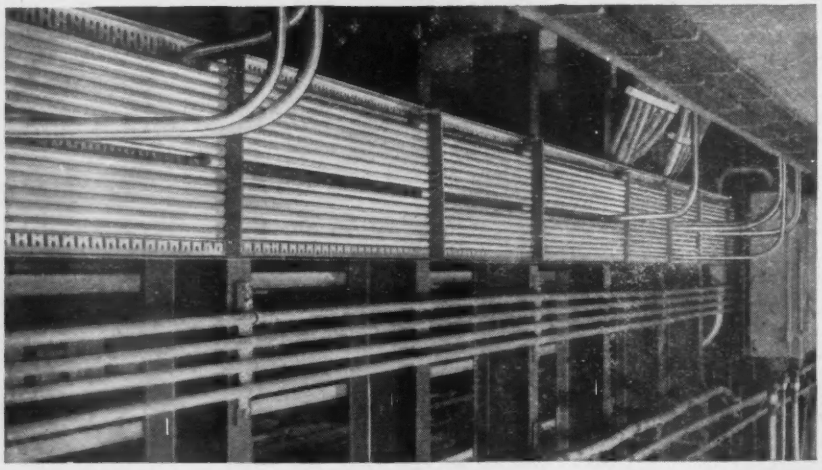
KEADBY & USKMOUTH

It was less than seven years ago that the world's first aluminium sheathed power cables were produced on a commercial basis—pioneered and perfected by Johnson and Phillips Limited. During this short space of time, J. & P. have supplied thousands of miles of this modern cable to power stations and industrial users of cable all over the world. At Stourport 'B' Station the J. & P. Contract Department has installed very large quantities of aluminium sheathed cables for control circuits and for auxiliary power supplies.

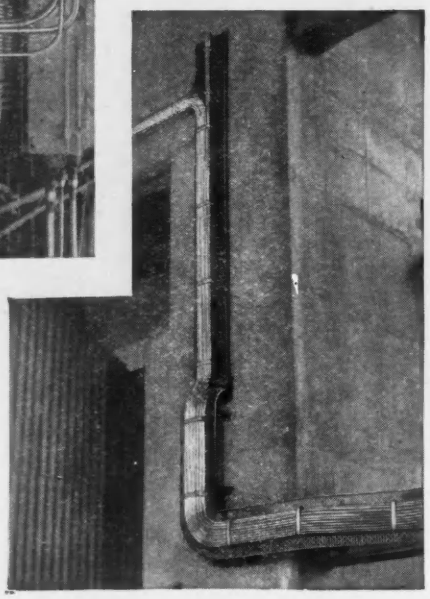


Photographs taken at Stourport 'B' Generating Station.

Consultants:
Messrs. Ewbank & Partners Ltd.



Above: A double bank of thirty J. & P. multi-core rubber insulated aluminium sheathed control cables.



Right: The ease of erection is well illustrated by this run of control cables mounted on perforated trays.

JOHNSON & PHILLIPS LTD.

CHARLTON · LONDON · S.E.7

ELECTRICAL ENGINEERS AND CABLE MAKERS

★ *FIRST IN THE WORLD WITH ALUMINIUM SHEATHED CABLES*

This is London . . .

but the same tools are used wherever you go!

These operations around well-known London landmarks are being undertaken with the aid of Warsop tools. But it isn't only London that has proved the rugged reliability of Warsop equipment. It is used all over the country to speed the work and cut the costs.

Sales and Service depots throughout the country are supplemented by a staff of mobile mechanics to provide prompt field service.

Makers of the S.7 Breaker, the H.D. Rock Drill, the BENJO Rammer and a range of centrifugal portable pumps.

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HEAVY DUTY SWITCHES
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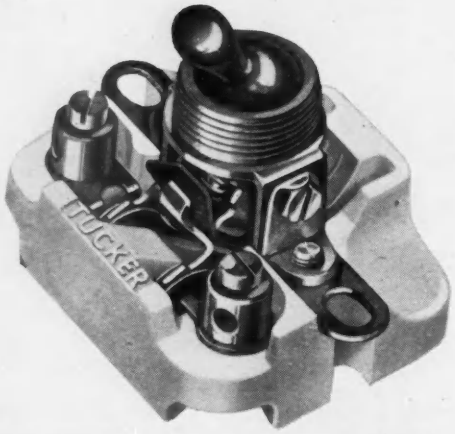
The Tucker B.4010 range of 5 amp. Quick Make and Quick Break switches ensure perfect mechanical operation independent of the spring, which is used only to accelerate and lock the movement.

The high standard of design combined with the use of the finest materials in manufacture have kept these switches in constant demand for many years.



The B.4000 range of switches is also available in 5 & 15 amp. double pole, intermediate, and ceiling patterns, thus providing independent switching arrangements for every application.

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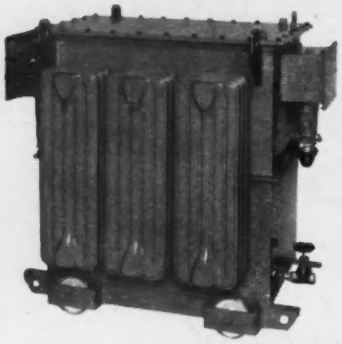

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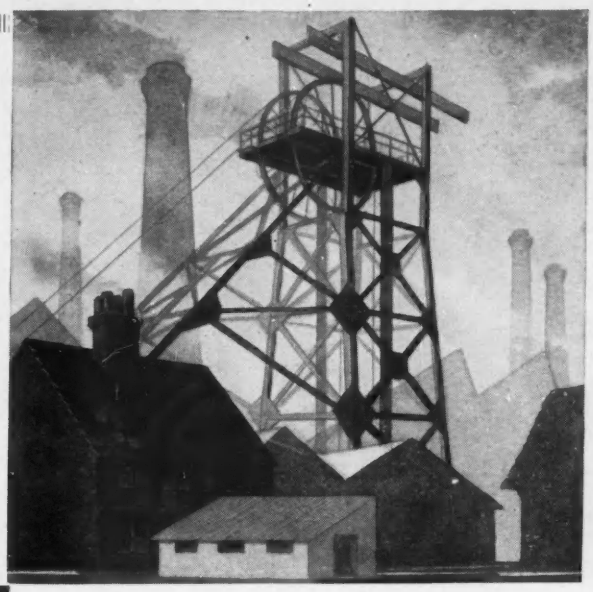
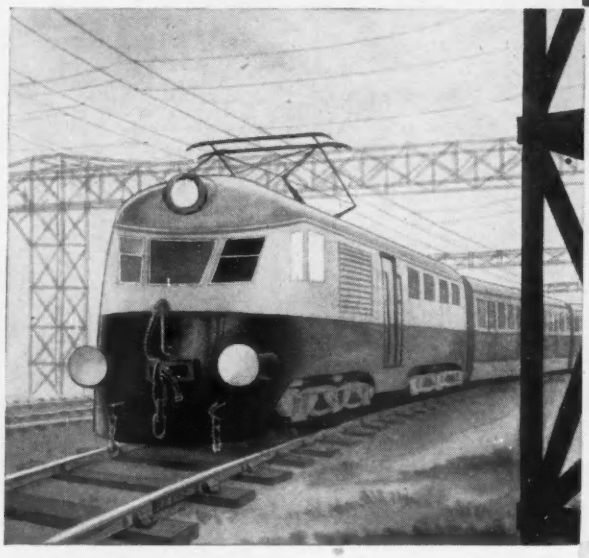
Current problems solved!





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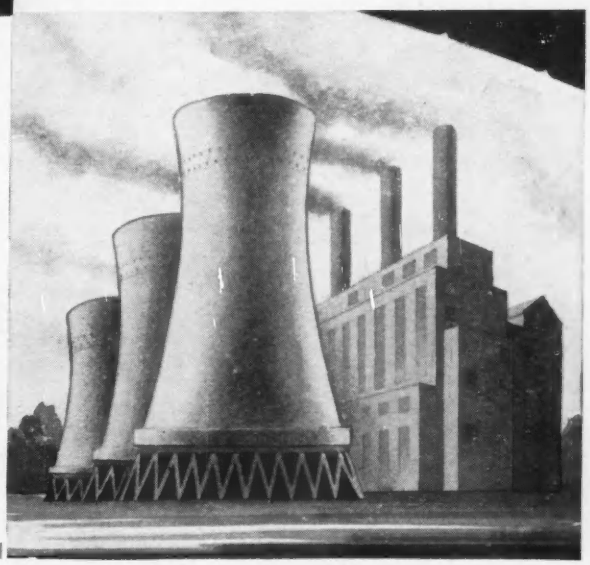

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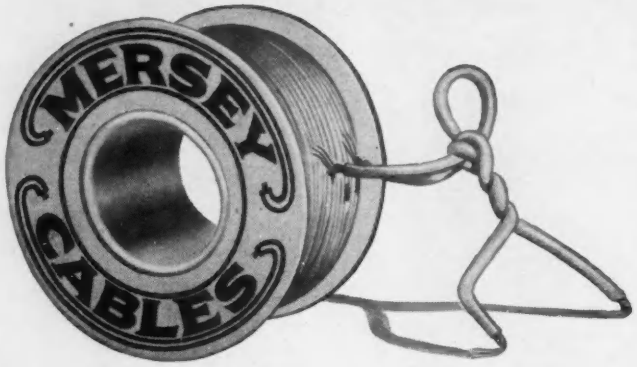

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RUBBER AND THERMOPLASTIC INSULATED WIRES, CABLES AND FLEXIBLES

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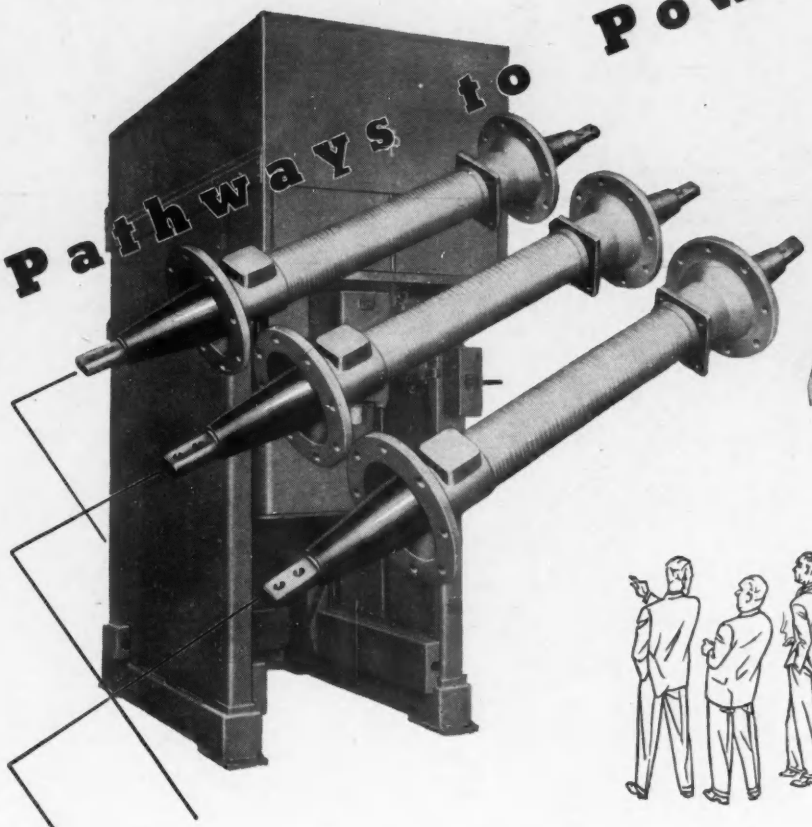
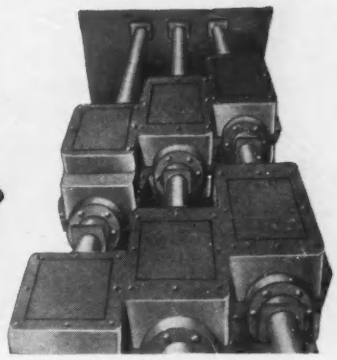
Pathways to Power...





Arrangement and connections of the condenser type busbars.

What are the essential requirements of Main or Substation Switchgear?

These may be numerous and not easy to designate in order of importance, but after thorough tests to ensure the all-important feature of RELIABILITY of all components under service conditions have been satisfactorily carried out, the advantage of ACCESSIBILITY to provide EASY MAINTENANCE is one to which "Ferguson Pailin" have given the closest attention in the design of the VLP 9 unit.

TYPE
VLP 9

A switch unit or switchboard of extremely CLEAN appearance for single or duplicate busbar installations.

RATINGS: Up to 33 kV 1000 MVA 1600 A.

Other notable features are:—

- **Provision of Current Transformers in AIR.**
- **Provision of CONDENSER Type Busbars.**
- **METAL division sheets are provided between Oil Circuit-Breaker and Cables.**
- **PHASE SEPARATED Oil Circuit-Breaker.**
- **Rapid Fault Clearance.**

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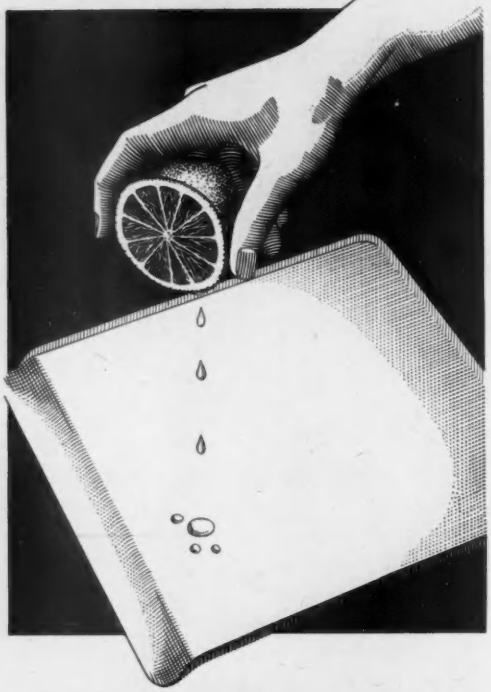

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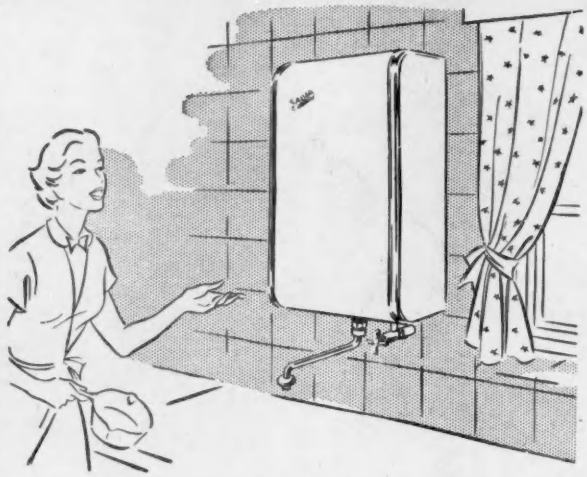
Pyroflex products have an unmatched reputation for exactitude and quality—for correct fit and long life enamel, resulting from 50 years practical experience in crownplates, splash plates, interiors and all sheet metal cooker parts.

JOHN KING & SON (ENAMELLERS) LTD
PYRO WORKS · CHESTERFIELD



we make ONLY electric water heaters *but* we DO make them WELL

The Sadia 'Select' is the latest product of the only specialists in electric water heating. 30 years of experience in this field are built into the Sadia Range of Electric Water Heaters, both large and small.

SADIA
Hot Water by Electricity

AIDAS ELECTRIC LTD., SADIA WORKS, ROWDELL ROAD, NORTHOLT, GREENFORD, MIDDX.
Phone: WAXLOW 1607

Agents for Scotland:—W. Brown & Co. (Engineers) Ltd., 89 Douglas Street, Glasgow, C.2.

Manufactured in S. Africa by:—Sadia Water Heaters (Pty) Ltd., 3-5 Newton Street, Village Main, Johannesburg.

Dependable small-power drives

by

B T-H

FRACTIONAL - HORSEPOWER MOTORS

The endless processes which make up the industrial pattern demand a reliable source of motive power. In the multitude of applications where an electric motor drive of between one thousandth of a horsepower and one horsepower is required, BTH "fractionals" provide economic service with the minimum of maintenance.

Single-phase	*1/8 to 1 h.p. up to 250 volts, 25 to 100 cycles.*
Three-phase	*1/6 to 1 h.p. up to 550 volts, 25 to 100 cycles.*
Direct current	*1/6 to 1 h.p. up to 520 volts.*

Many sizes can be supplied from stock.

For low-speed drives a comprehensive range of geared motor units is available.

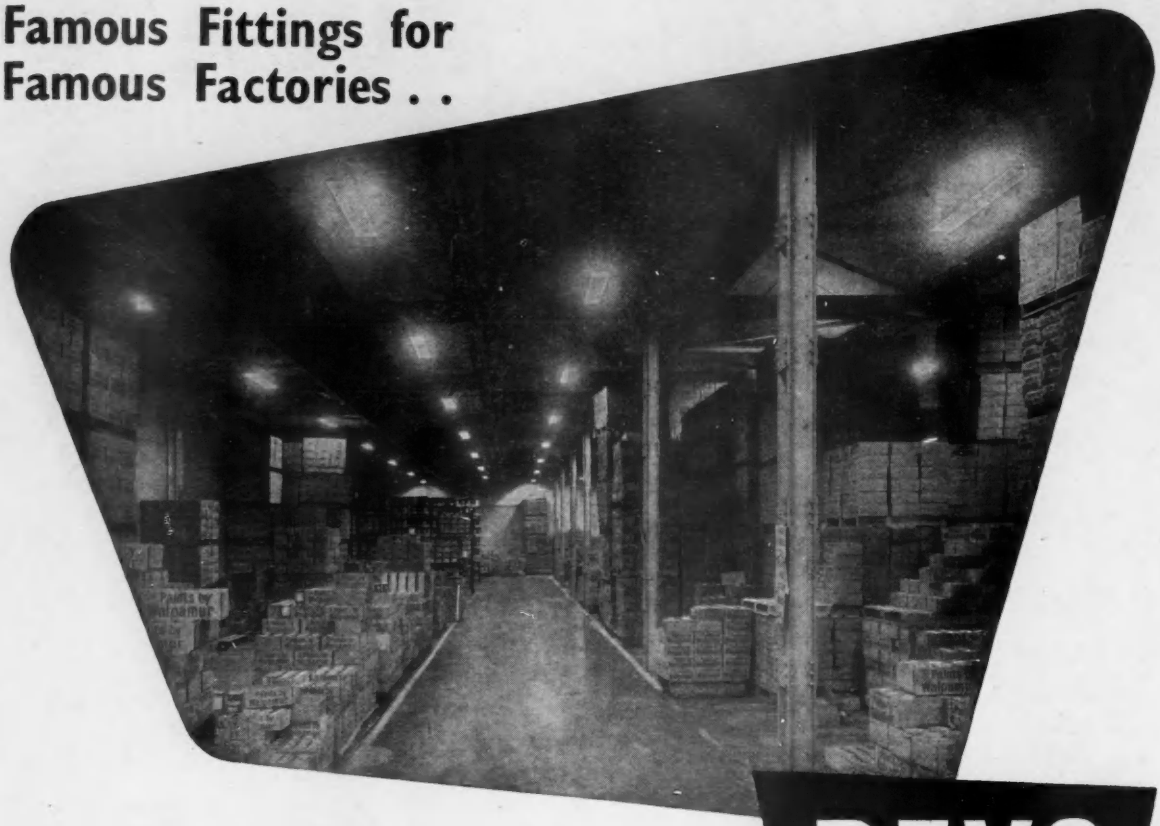
All BTH fractional-horsepower motors comply in every respect with British Standard 170.

THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND

Member of the A E I group of companies

A4648

Famous Fittings for Famous Factories . .



WALPAMUR chooses

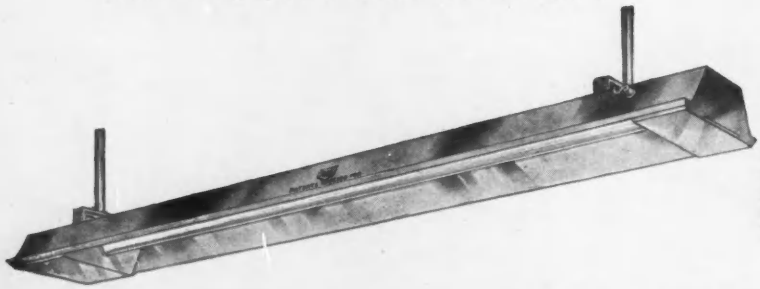
REVO REGD.

TRUFOLITE REFLECTOR FITTINGS

Like many other important manufacturers, the Walpamur Co. Ltd. selected Revo Fluorescent Fittings for the efficient lighting of their premises at Darwen.
Over 400 fittings have been installed in the factory and offices and the accompanying photograph shows a section of the stock room and forwarding department where the well-known Revo "Trufolite" units have been installed, each using one 5 ft. 80 watt fluorescent lamp.

★ ★

The services of the Revo Lighting Department are available to clients and the company's engineers will be pleased to advise on any lighting problem or prepare schemes for proposed installations without obligation.



Revo "Trufolite" Fluorescent Fittings are supplied for one or two 40 watt, 4 ft. and one, two or three, 80 watt 5 ft. Fluorescent lamps and can be arranged for chain, tube or direct mounting separately or in continuous lines.

REVO ELECTRIC CO. LIMITED, TIPTON, STAFFS TELEPHONE: TIPTON. 1891 TELEGRAMS: REVO TIPTON

Branches at: LONDON, MANCHESTER, CARDIFF, GLASGOW, LEEDS, NEWCASTLE-ON-TYNE, BELFAST, DUBLIN

Electric Cookers, Domestic Appliances, Public and Industrial Lighting Equipment, Switch and Fusegear, Electric Fans

Fans for confined spaces

See how little space is occupied by this 5-stage Woods *Aerofoil* fan . . . how compactly it fits into the ducting. A two-stage contra-rotating fan can develop 7″ s.w.g. It is smaller than a comparable centrifugal, simpler to install, requires no bulky bends, no floor space, and consumes less current. High pressures are no longer the prerogative of the centrifugal fan; Woods multi-stage *Aerofoil* fans can develop 20″ s.w.g. or more. Woods fan engineer in your area will be happy to call. Write for publication V1089.

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WOODS OF COLCHESTER LIMITED, BRAISWICK WORKS, COLCHESTER

An associate company of The General Electric Company Ltd.

Technical Representative at :

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Cardiff: *Phone: 28055*
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Liverpool: *Phone: Royal 7282*
London: *Phone: Chancery 5474*
Manchester: *Phone: Blackfriars 3434*
Middlesbrough: *Phone: 3621*
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Sheffield: *Phone: 25101*
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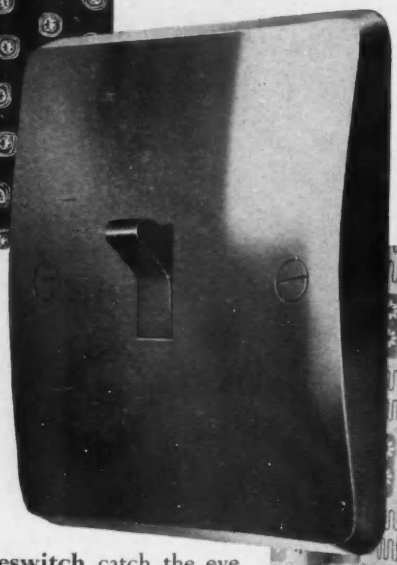
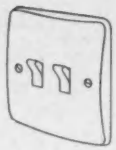
MK98DHB

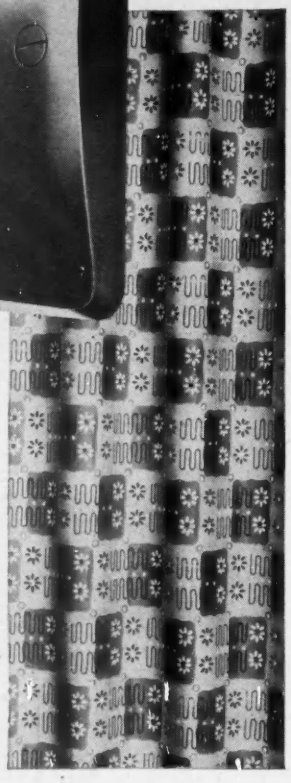
the **Plateswitch** *A distinctive new development in switch design*



the Plateswitch fits into the background of modern decoration



the compact 2-gang unit has the same dimensions as the 1-gang



The clean modern lines of the new **MK Plateswitch** catch the eye immediately. Here is a design that speaks discreetly of quality. Look at it again, and every detail of its construction and finish confirms the first impression.

Easy installation, with generous, well placed terminals; B.S. 1299 fixing centres on both one and two gang patterns; automatic levelling with the plaster; smooth, silently-controlled performance—these features combine to make the **Plateswitch** as attractive as its appearance suggests. Here, too, is a distinct price appeal. The **Plateswitch** qualifies on cost for the most competitive work. Ask for Leaflet 227 and compare the value.

THESE ADVANTAGES SIMPLIFY STOCKING

Every **Plateswitch** is supplied with four screws to match—two 4BA for metal boxes and two No. 5 wood screws for wood boxes.

The two gang **Plateswitch** has two 2-way switches only, each or both of which can be wired as 1-way.

MK ELECTRIC

. . . the mark of leadership

M. K. Electric Limited, Wakefield Street, Edmonton, London N.18. Edmonton 5151

Motors and control gear for every need . . . perfectly matched and at the *right* price.

Good control gear is the first line of defence for the protection of valuable machinery. Adjustable overloads protect motors but allow them to do the maximum amount of work.
BROOK equipment offers you long, reliable life with minimum attention.

1904 BROOK MOTORS LTD 1954

HUDDERSFIELD • ENGLAND

I. NE. 306

B

An OUTDOOR Circuit Breaker

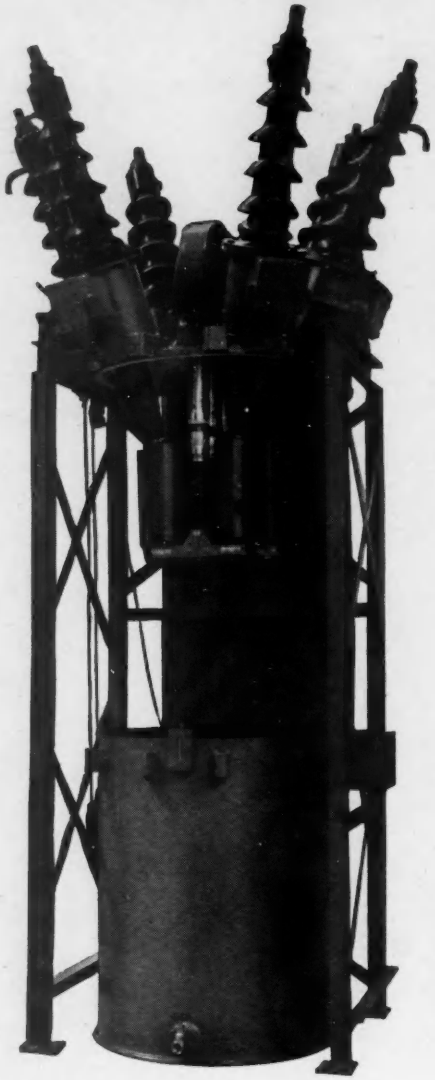
(pneumo-hydraulically operated)

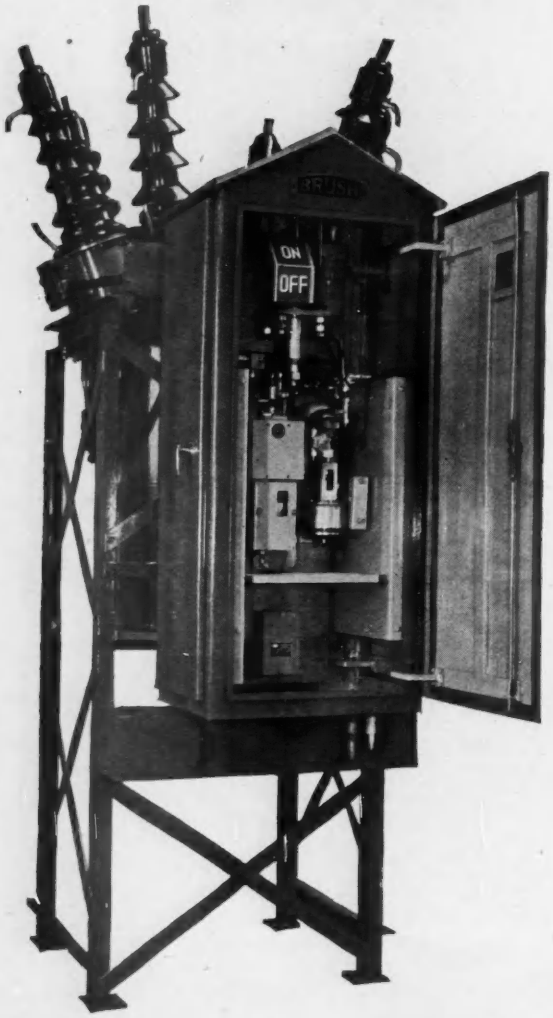
IN THE DESIGN of this bulk-oil Circuit Breaker the mechanical construction is simple and generous to ensure permanently satisfactory performance under the most arduous conditions of service.

Built to comply with British Standard 116-1937 (Part 2) it has been subjected to short circuit test and certified for the rating assigned—i.e. 1,000 amps.—750 MVA Breaking Capacity—33 and 38.5 kV.

The illustration left shows a circuit breaker fitted with apparatus for pneumo-hydraulic operation. The circuit breaker may be closed four times in succession without recourse to auxiliary power supply.

As an alternative BRUSH Outdoor Circuit Breakers can be fitted with Solenoid Operating Mechanism.





For full information write TODAY for our NEW Publication No. 41166/A.

BRUSH 33/38.5kV

Oil Circuit Breakers

BRUSH ELECTRICAL ENGINEERING CO., LTD., LOUGHBOROUGH, ENGLAND

B 18

SIEMENS

SAFETRIP

Earth Leakage Switch Socket for Sub-Circuit Protection

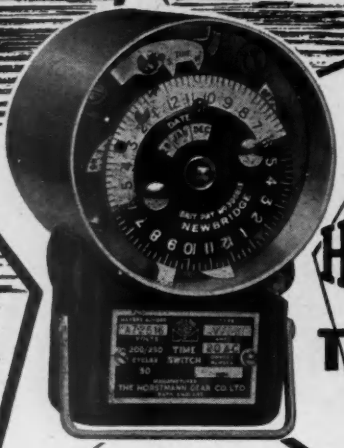
This robust and inexpensive addition to the Siemens range of Earth Leakage protection devices has been specifically designed for protection against shock on sub-circuits. Consisting of a 15 ampere Double Pole Earth Leakage Circuit Breaker controlling a 13 ampere shuttered socket outlet, the unit complies with B.S.S. 1363/1947 and B.S.S. 842/1939. The "Safetrip" is available for either flush or surface mounting and can be supplied as a separate unit without the shuttered socket for use with sockets already installed.

Cat. No.	Description	Dimensions	Price
EL 15/S	With 3-pin Socket, excluding box	5 11/16" x 4" x 2 3/16"	37/-
EL 15	Without 3-pin Socket, excluding box	5 11/16" x 4" x 2 3/16"	32/3
SSB 15	Steel Conduit Box, Flush mounting	5 1/16" x 3 1/16" x 1 1/16"	3/8
BSB 15	Moulded Conduit Box, Surface mounting	5 3/8" x 4" x 1 1/16"	3/4

For full technical details write for leaflet No. 73

SIEMENS ELECTRIC LAMPS & SUPPLIES LIMITED
38-39 UPPER THAMES STREET, LONDON, E.C.4

Stars of the lighting world



HORSTMANN TIME SWITCHES

WINGS DAY
SEPT 18th
Give for those who Gave

Type "V"

The comprehensive range covers hand wound models (15, 21 & 40 day run), electrically wound models and synchronous models with or without spring reserve, as required. Models are available for public lighting, off peak tariff and shop window lighting control, etc., etc.

Many years of experience in the design and manufacture of automatic lighting appliances ensure that HORSTMANN TIME SWITCHES meet the exacting demands of modern lighting control.

The illustrations show the Type "V" 20 amp and the Type "Y" 20 amp. switches. The latter is electrically wound and incorporates a spring reserve. Its compact size makes it particularly suitable for use in the base of lamp columns where space is limited.

Type "Y"

THE HORSTMANN GEAR CO. LTD.

NEWBRIDGE WORKS · BATH · ENGLAND TEL: 7241

when you hear people talking about storing electric energy they really mean Thermodare

More and more people are seeing the wisdom of Thermodare heating. They acclaim its merits far and wide. What it amounts to is this—cheaper heating because it uses electricity only at night; trouble-free heating because no attention is needed; and efficient heating because premises are warm first thing in the morning and stay warm during the day. Our literature tells you more about it. Just send us your name and address.

THERMODARE

THERMODARE (GREAT BRITAIN), 79/80 PETTY FRANCE, LONDON, S.W.1
Telephone: ABBey 1060

VERSCO

wash boilers
new editions of
a famous range

VERSCO SQUARE BOILER

VERSCO ROUND BOILER

VERSCO SQUARE DE LUXE BOILER. This smart and compact boiler is fitted with castors for easy movement and is finished in cream stove enamel. The table-top in cream vitreous is an attractive feature.

VERSCO ROUND BOILER. Obtainable in Galvanised finish as shown (a most durable finish of special appeal for Corporation and other housing schemes) or in cream stove enamel.

THESE FEATURES ARE COMMON TO ALL VERSCO MODELS: Heavily tinned 10 GALLON copper container —Double pole 3 heat rotary switches A.C. or D.C. (safety cut-out available if required)—Chromium plated taps with heat-resisting handles—Six 500 W clamp-on elements give maximum loading of 3 Kw.—Top surrounds in die-cast aluminium and pressed aluminium loose lids for easy access.

Send for new leaflet giving full specifications and prices.

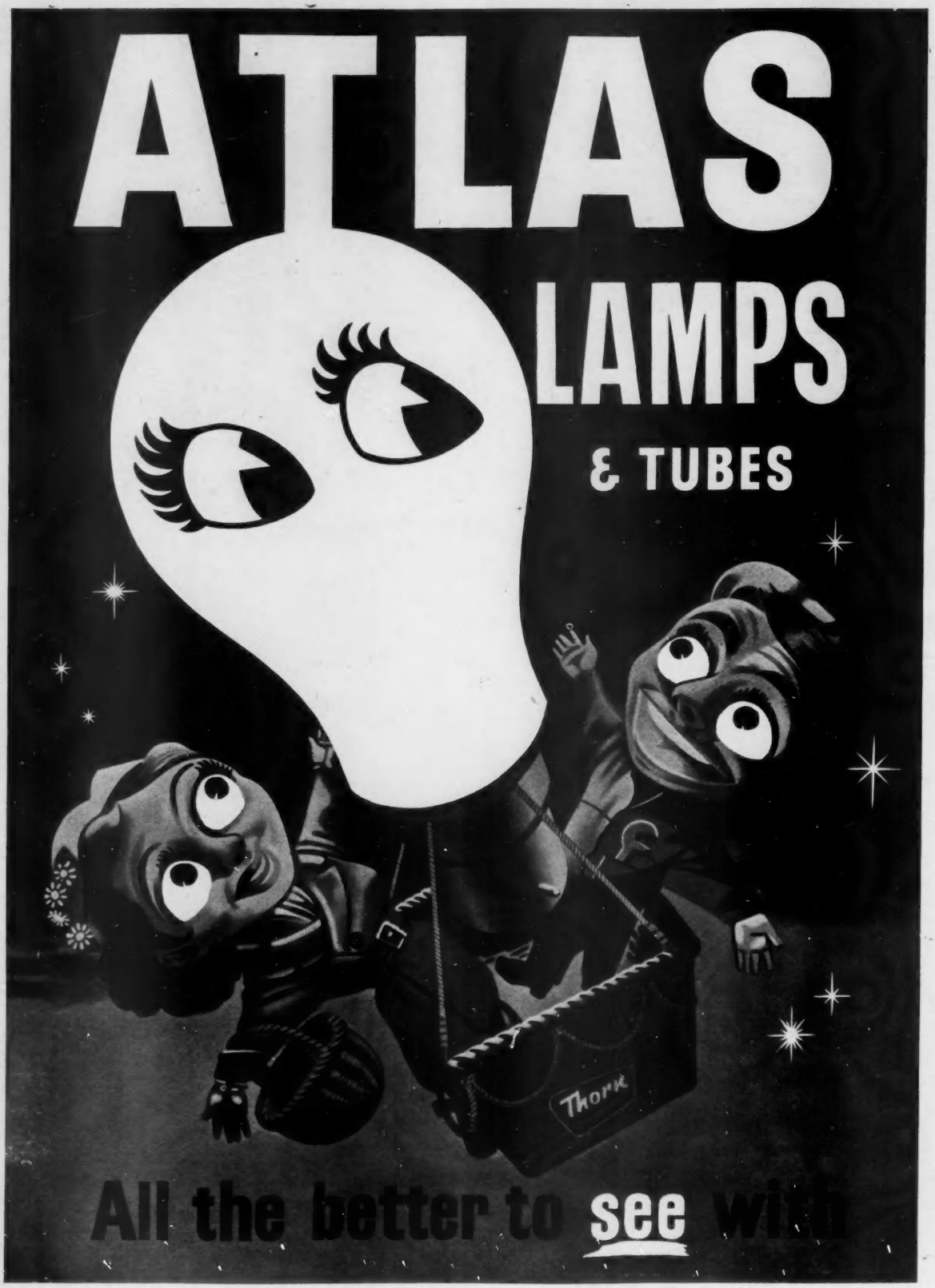
SWIRLUX

WASHING MACHINES

500H MODEL heats the water, 6 lb. dry weight capacity, 12" wringer which folds down when not in use. Exclusive Swirlux agitator. (Unheated version 500 MODEL also available.)

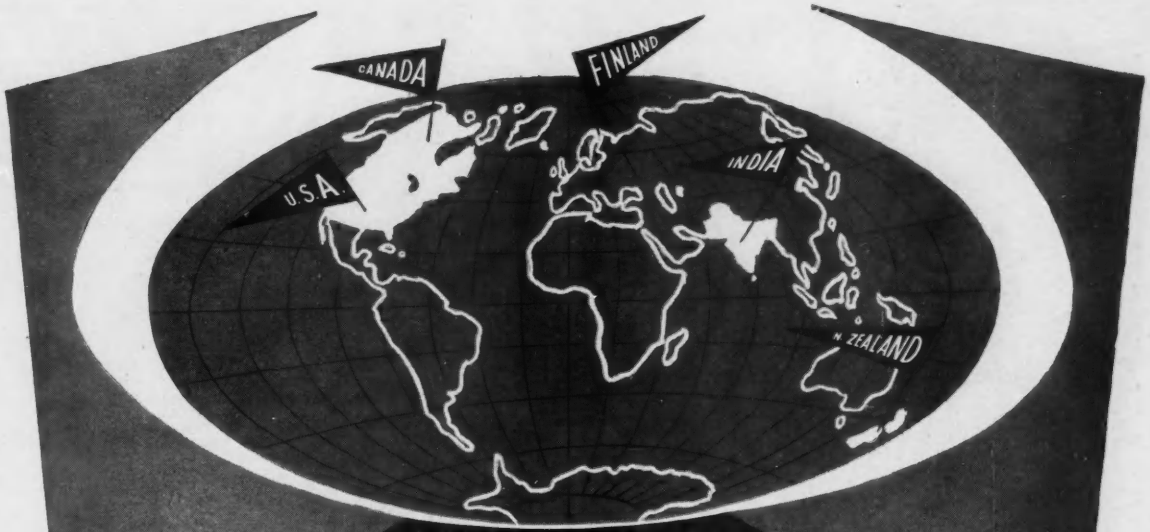
503 MODEL— 10/11 lb. dry weight capacity, full size power wringer with five working positions. Exclusive Swirlux agitator. Power pump and hose for quick emptying. For full details send for Swirlux Leaflets.

Universal Boilers & Engineering Co. Ltd., Fulledge Works, Burnley, Lancs.
TELEPHONE: 2121 and 2263



Thorn

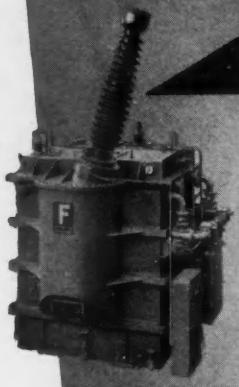
THORN ELECTRICAL INDUSTRIES LTD., Atlas Lighting Division, 233 Shaftesbury Avenue, London, W.C.2



FERRANTI

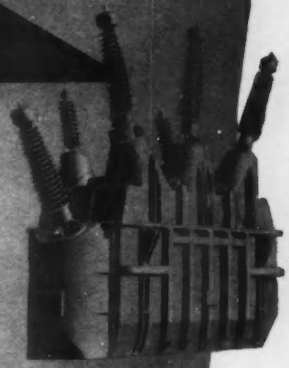
TRANSFORMERS

FAMOUS THROUGHOUT THE WORLD



U.S.A. Nine 33,333 kVA, 230,000 volt single-phase Ferranti transformers are being supplied to the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota, U.S.A. Three, forming the first 100,000 kVA bank, have been shipped.

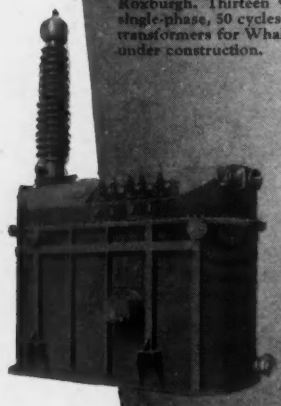
FINLAND Six 230,000 volt, three-phase Ferranti transformers have been ordered by the Imatra Power Company, Finland, for the Hikia Transforming Station and the Pyhäkoski Generating Station. Five are now in commission.

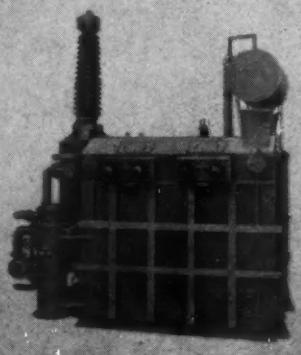


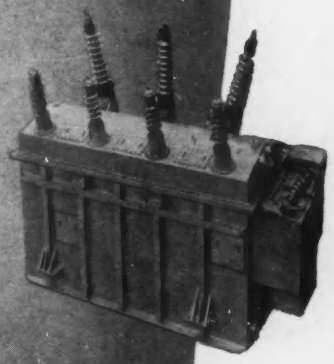
NEW ZEALAND Twenty-six Ferranti large power transformers have been ordered by the State Hydro-Electric Department of New Zealand. Thirteen 14,800 kVA, single-phase, 50 cycles, 11/220 kV transformers have already been supplied to Roxburgh. Thirteen 9,259 kVA, single-phase, 50 cycles, 11/220 kV transformers for Whakamaru are under construction.

CANADA Four 71,000 kVA, 301,400 volt single-phase Ferranti generator transformers and three 37,000 kVA, 275,000 volt step-down Ferranti transformers have been supplied to the Aluminum Company of Canada Limited for the Alcan Project at Kemano and Kitimat, British Columbia.

INDIA Three Ferranti 20,000 kVA, OFB, 3-phase, 50 cycles, 132/33.66 kV Transformers with on-load tap changing gear and two Ferranti 10,000 kVA, ON/OB, 3-phase, 50 cycles, 132/33 kV transformers with on-load tap changing gear have been supplied for the Damodar Valley Power Scheme in India.







FERRANTI

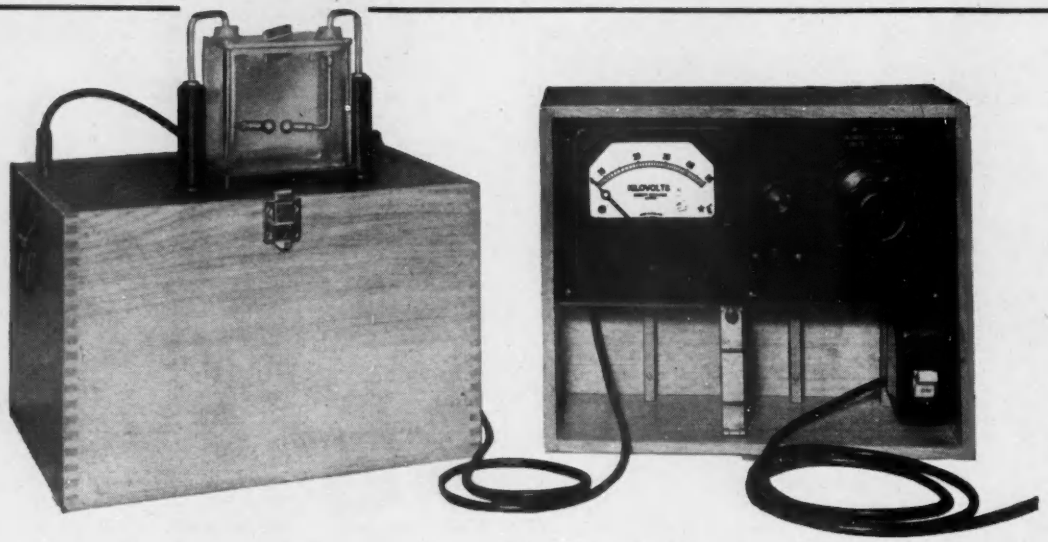
FERRANTI LTD · HOLLINWOOD · LANCS

London Office: KERN HOUSE, 36 KINGSWAY W.C.2

FT.146

Portable Insulating Oil Tester

For the rapid testing of Transformer and Switch Oils



General arrangement, showing Test and Control units, which nest together for transport.

50 kV Test voltage
Continuous smooth variation from 0 to 50 kV.

Transportable
Self-contained in one case comprising separate Control Unit and Test Unit.

Excellent Wave-form
Minimum Wave-form distortion under all test conditions.

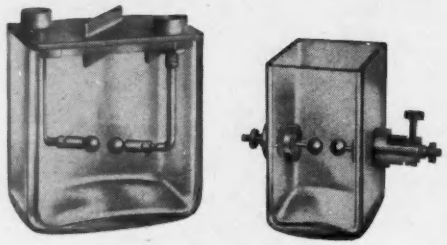
BS 148 : 1951
The equipment conforms fully to this specification with additional facilities.

Automatic Protection
Supply is cut off when breakdown of oil occurs.

Remote operation
The Control Unit is detachable from the Test Unit for operation.

Safety
A Spring-Loaded Double-Pole Primary Control Switch prevents inadvertent operation.

4" Scale Indicator
With bold-pointer and easily read scale.



Alternative types of test cell

CATALOGUE SHEET No 500 E

EVERETT EDGCUMBE

Designers and manufacturers of almost every type of electrical indicating and recording instrument.
Specialists in: Speed Recording, Photometry, Process Time Control, Telemetering.

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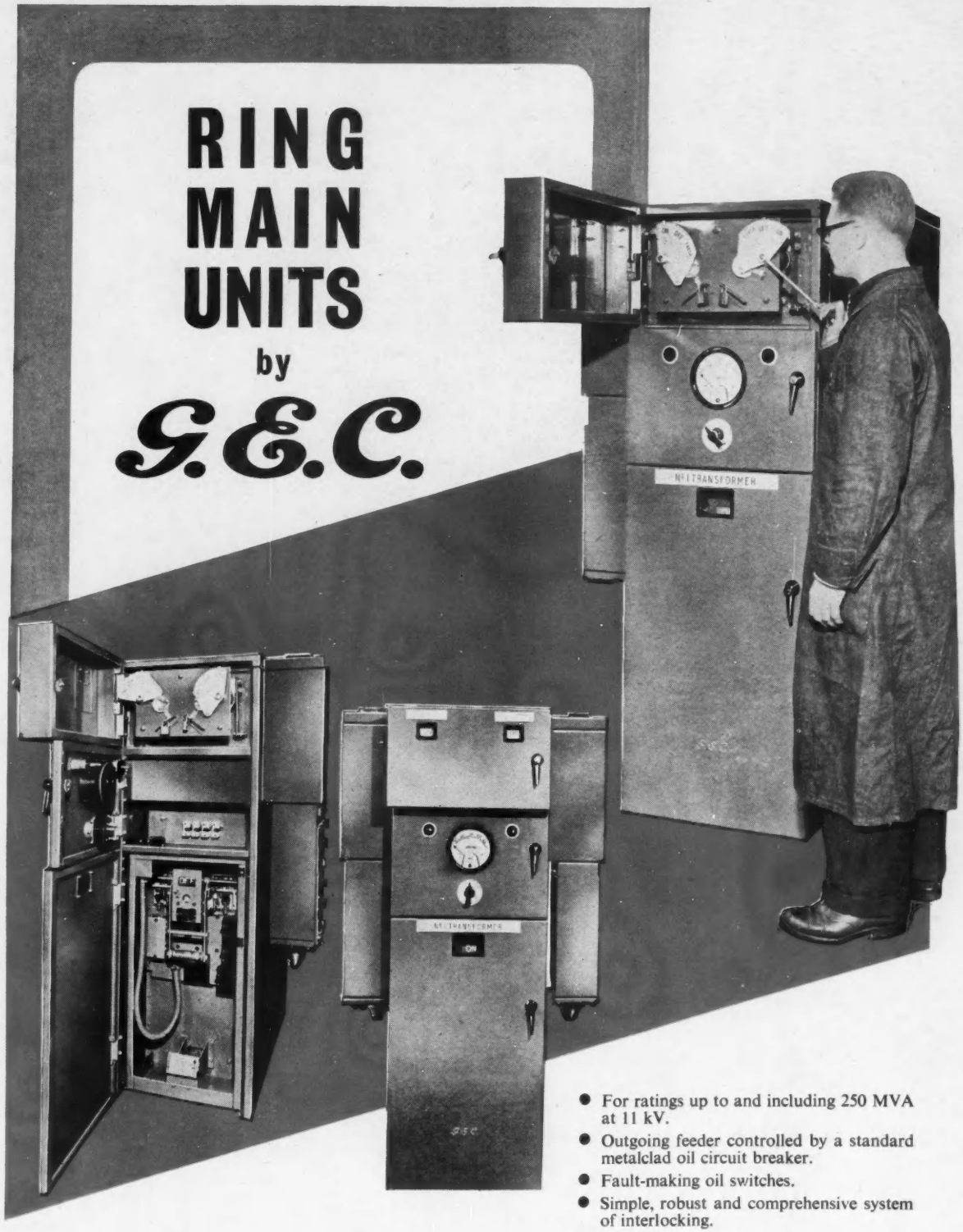
DHB

RING MAIN UNITS by G.E.C.



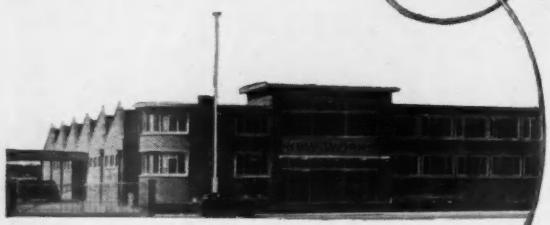
- For ratings up to and including 250 MVA at 11 kV.
- Outgoing feeder controlled by a standard metalclad oil circuit breaker.
- Fault-making oil switches.
- Simple, robust and comprehensive system of interlocking.
- Available in extensible and non-extensible form.

THE GENERAL ELECTRIC CO., LTD. MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

On our past

We build our future

FOR MANY YEARS we have served the needs of industry from our works at Kew... and we can look back on that period with a satisfaction that is justified by the many friends we have made. But the march of progress is inevitable... business commitments have grown, demands have increased. To meet these demands for our already comprehensive range of covered wires, we have built these modern premises at Bracknell.
Output will be increased, but our growth will not bring impersonality... we will retain the characteristics of the personally conducted business... on that we built our past... so will we build our future,



Kent Bros. Electric Wire Co.

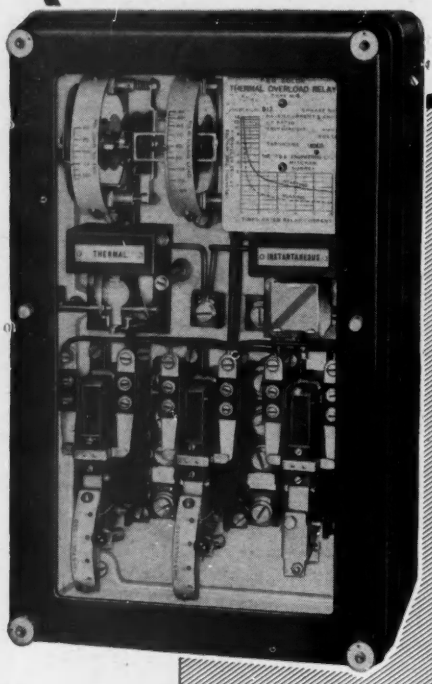
& E.H. Phillips Limited

KEW WORKS, BRACKNELL
Berks. *phone: Bracknell 881 (4 lines)*
grams: Encosil Bracknell Berks.

K KEW W

SK 354

PROTECT YOUR MOTORS with P & B Golds' Relays



For motors with any starting periods or starting currents under extremes of ambient temperature.

Send for descriptive pamphlet.

THE P & B ENGINEERING CO · LTD
CRAWLEY · SUSSEX
TELEPHONE: CRAWLEY 1200

Now!

A 13 Amp. Fused Plug

To retail at

3/8 each.

in Resilient Rubber . . . by

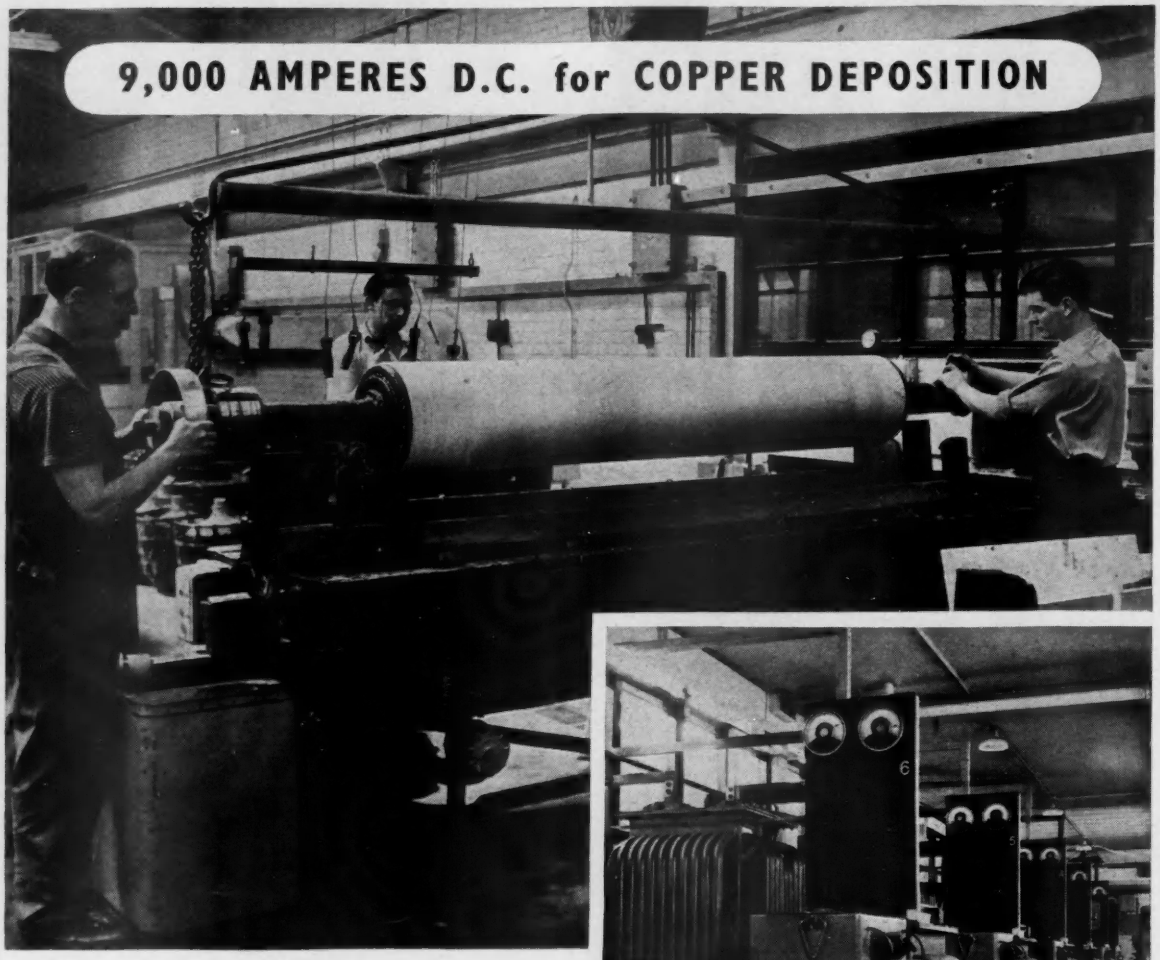
SANDERS
WEDNESBURY

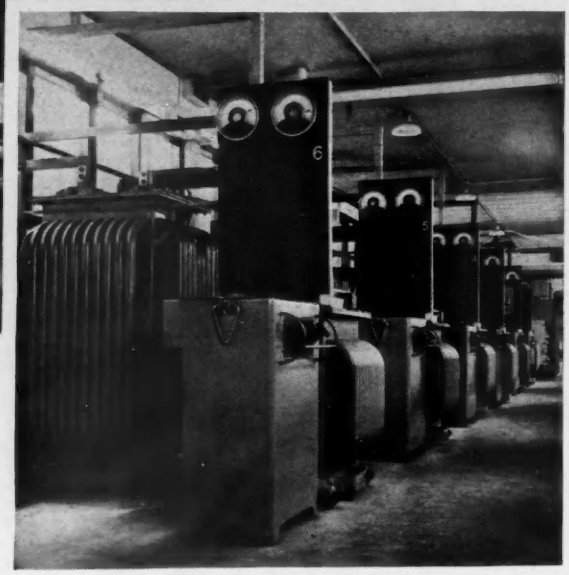
Makers of unbreakable Plugs since 1937

LEAFLET 152
GIVING FULL DETAILS ON REQUEST

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

9,000 AMPERES D.C. for COPPER DEPOSITION



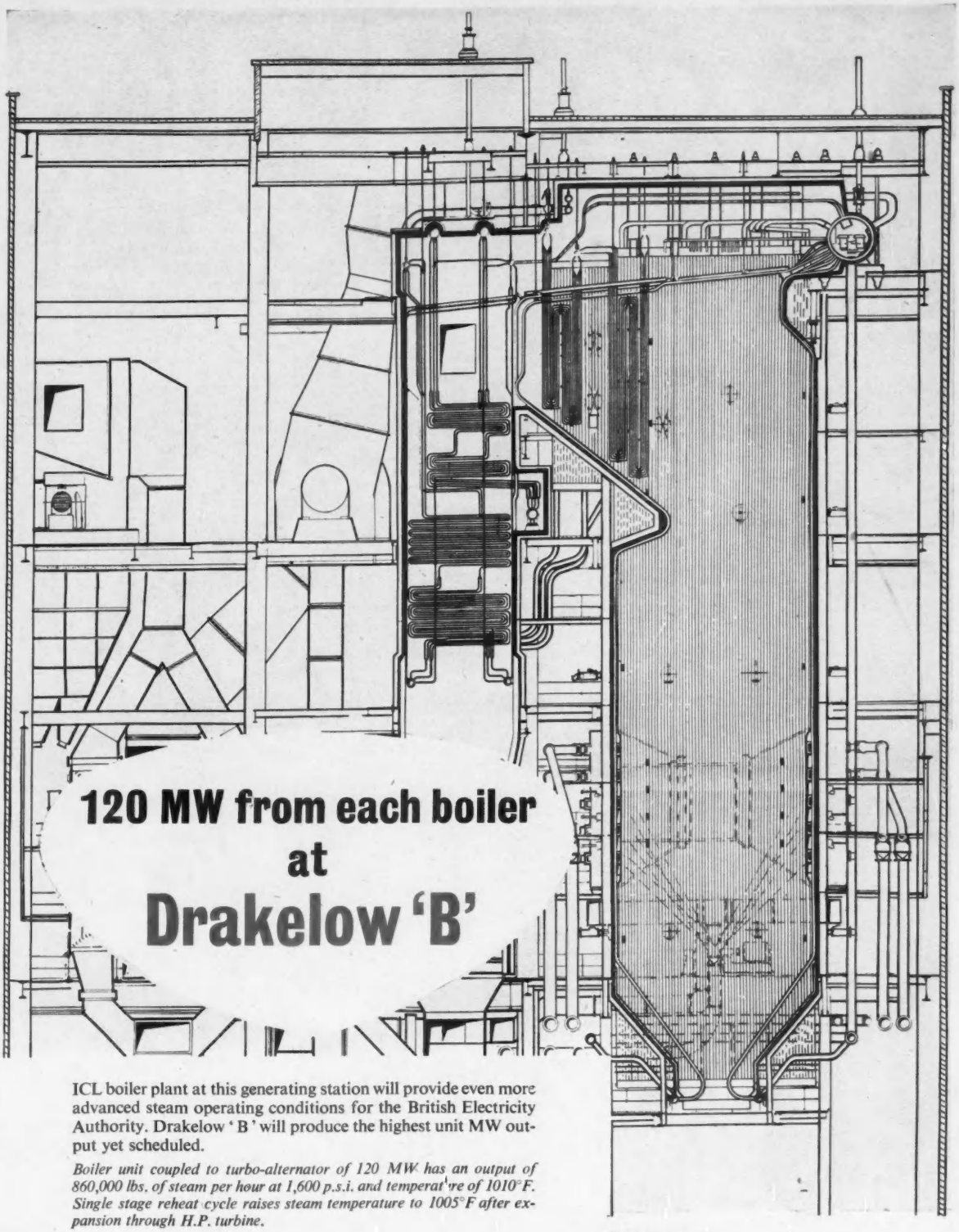


Westalite heavy current rectifiers are used extensively in the printing industry for many processes. The installation at Messrs. Copper Depositing and General Engineering Co. Ltd., (by whose courtesy these photographs are reproduced) consists of six Westalite oil-immersed rectifiers each with an output of 1,500 amperes at 7·5 volts, feeding six separate baths. Printing rollers, ranging in size from 300 square inches, 21″ × 14″ circumference to 4,000 square inches, 77″ × 50″ circumference, are processed for the photogravure and allied trades, receiving a copper deposit of ·005 inches thick. In all an average of 6 tons of copper per year is deposited on rollers of varying sizes.

WESTALITE

PLATING RECTIFIERS

WESTINGHOUSE BRAKE & SIGNAL COMPANY LIMITED
DEPT. E.T.17. 82, YORK WAY, KING'S CROSS, LONDON, N.1



120 MW from each boiler at Drakelow 'B'

ICL boiler plant at this generating station will provide even more advanced steam operating conditions for the British Electricity Authority. Drakelow 'B' will produce the highest unit MW output yet scheduled.

Boiler unit coupled to turbo-alternator of 120 MW has an output of 860,000 lbs. of steam per hour at 1,600 p.s.i. and temperature of 1010°F. Single stage reheat cycle raises steam temperature to 1005°F after expansion through H.P. turbine.

Up goes efficiency with ICL equipment

INTERNATIONAL COMBUSTION LIMITED · London Office: Nineteen Woburn Place, W.C.1

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SG.46

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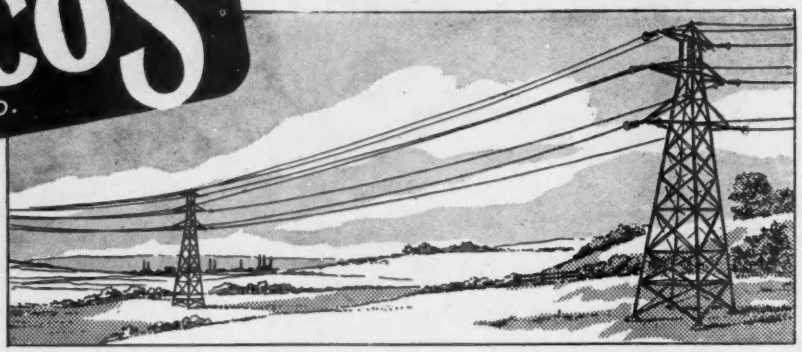

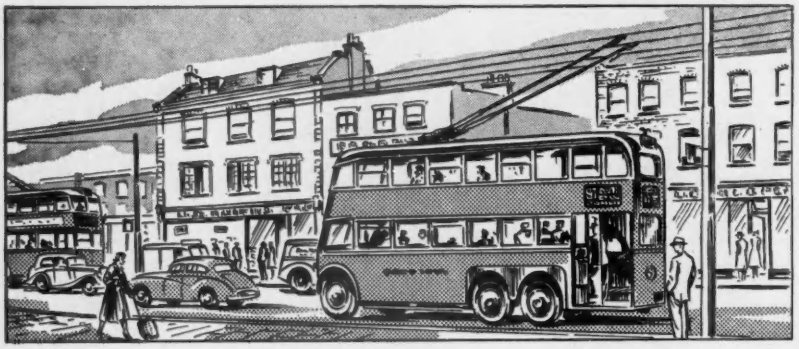

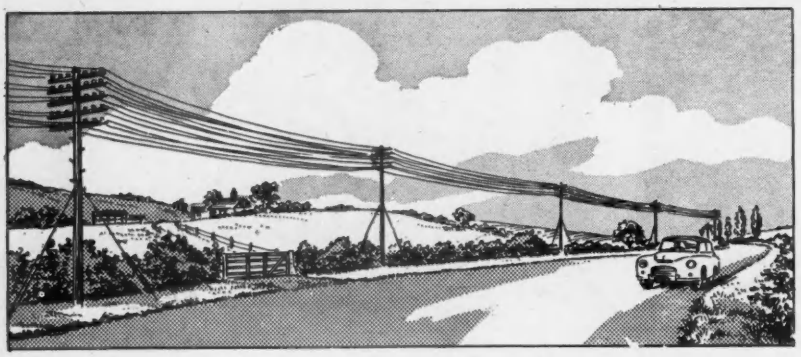

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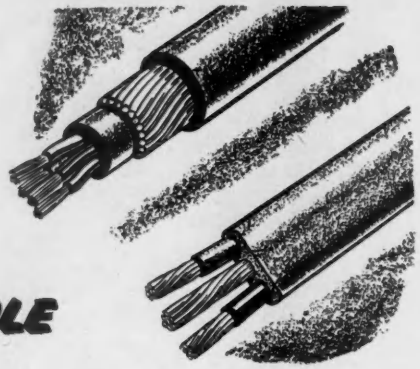

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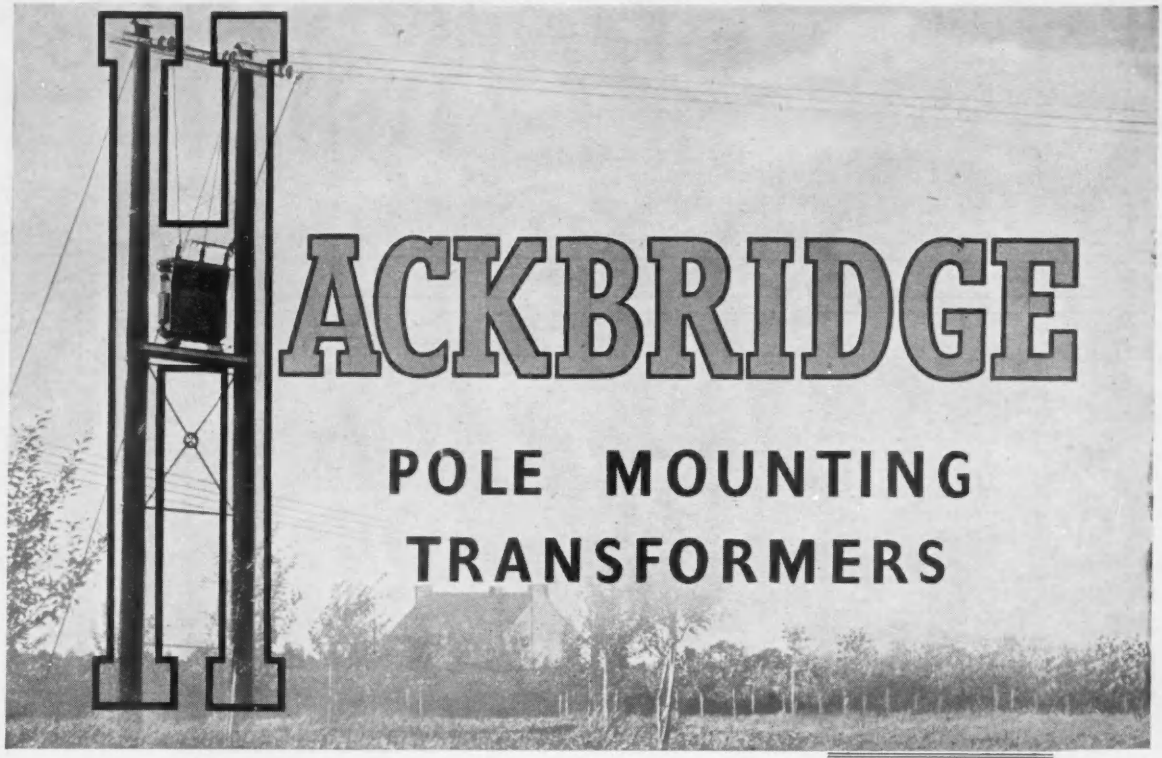

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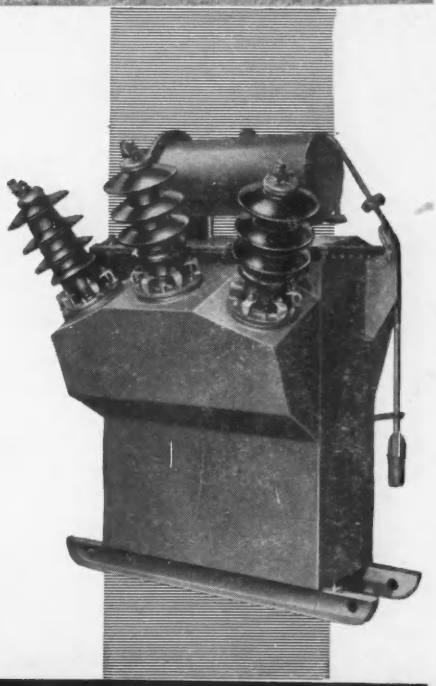

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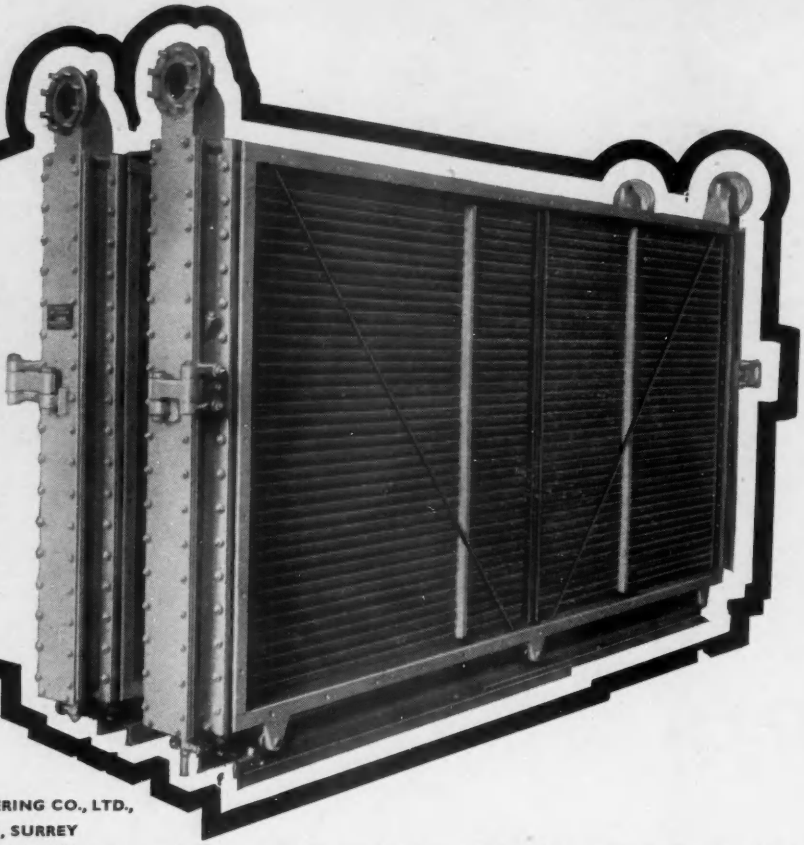

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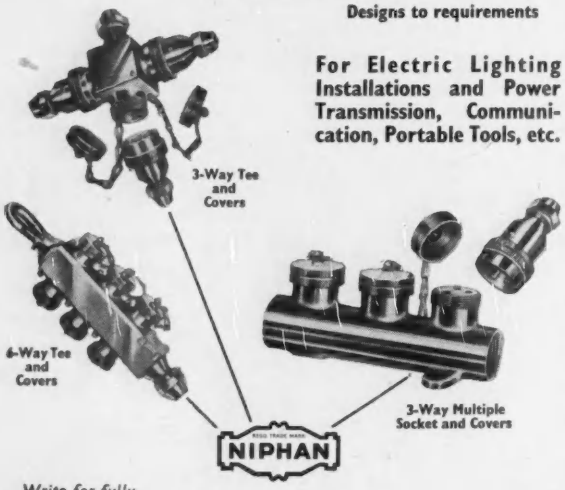

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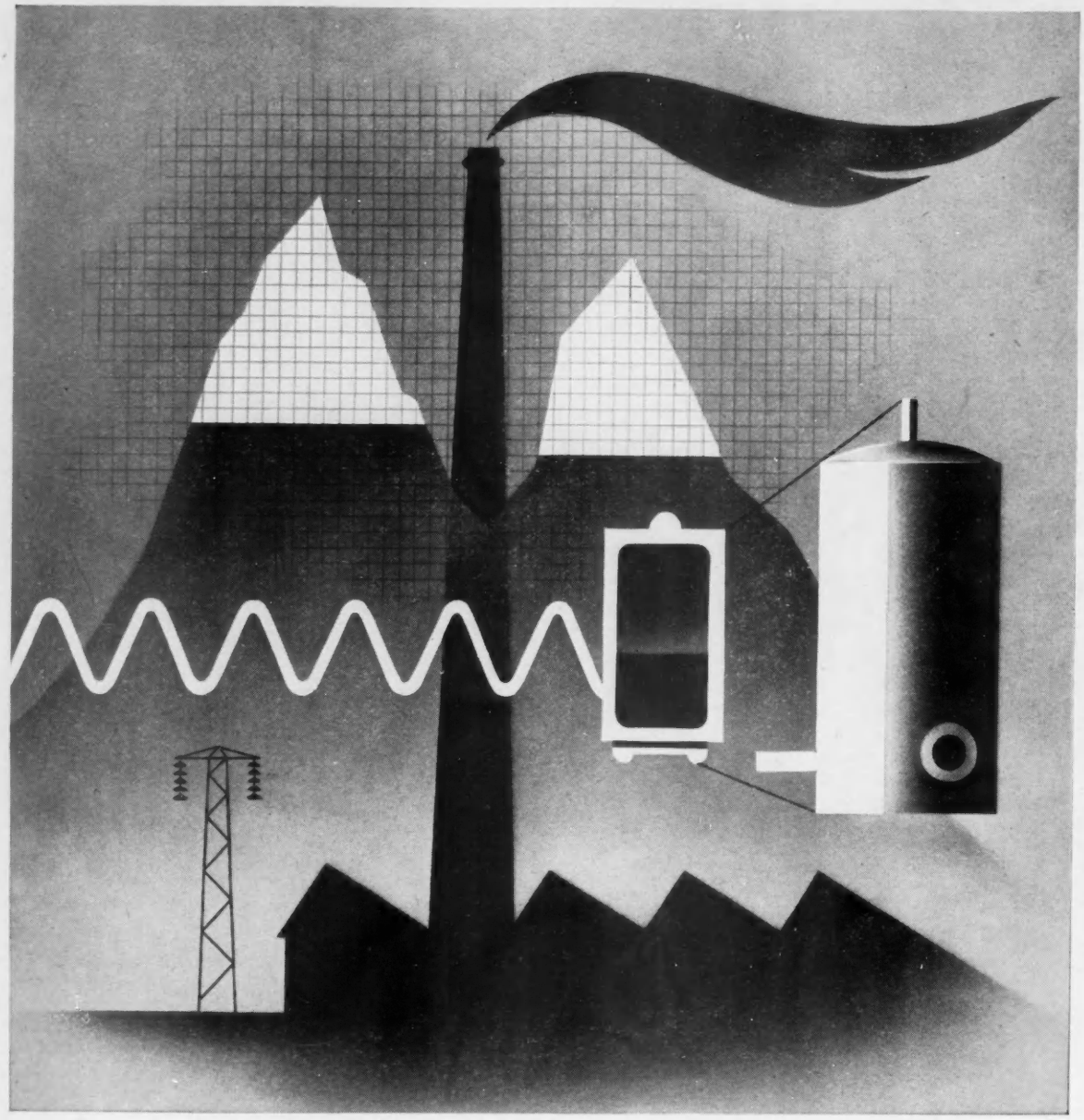

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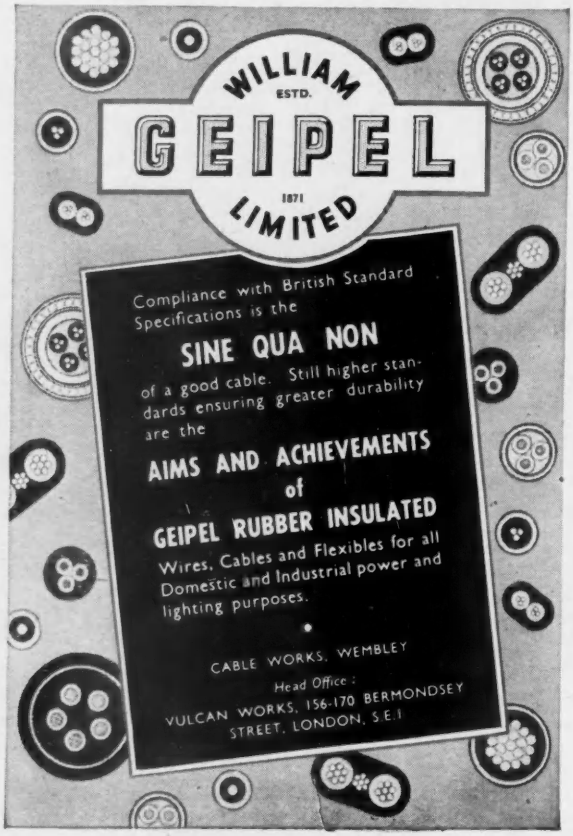
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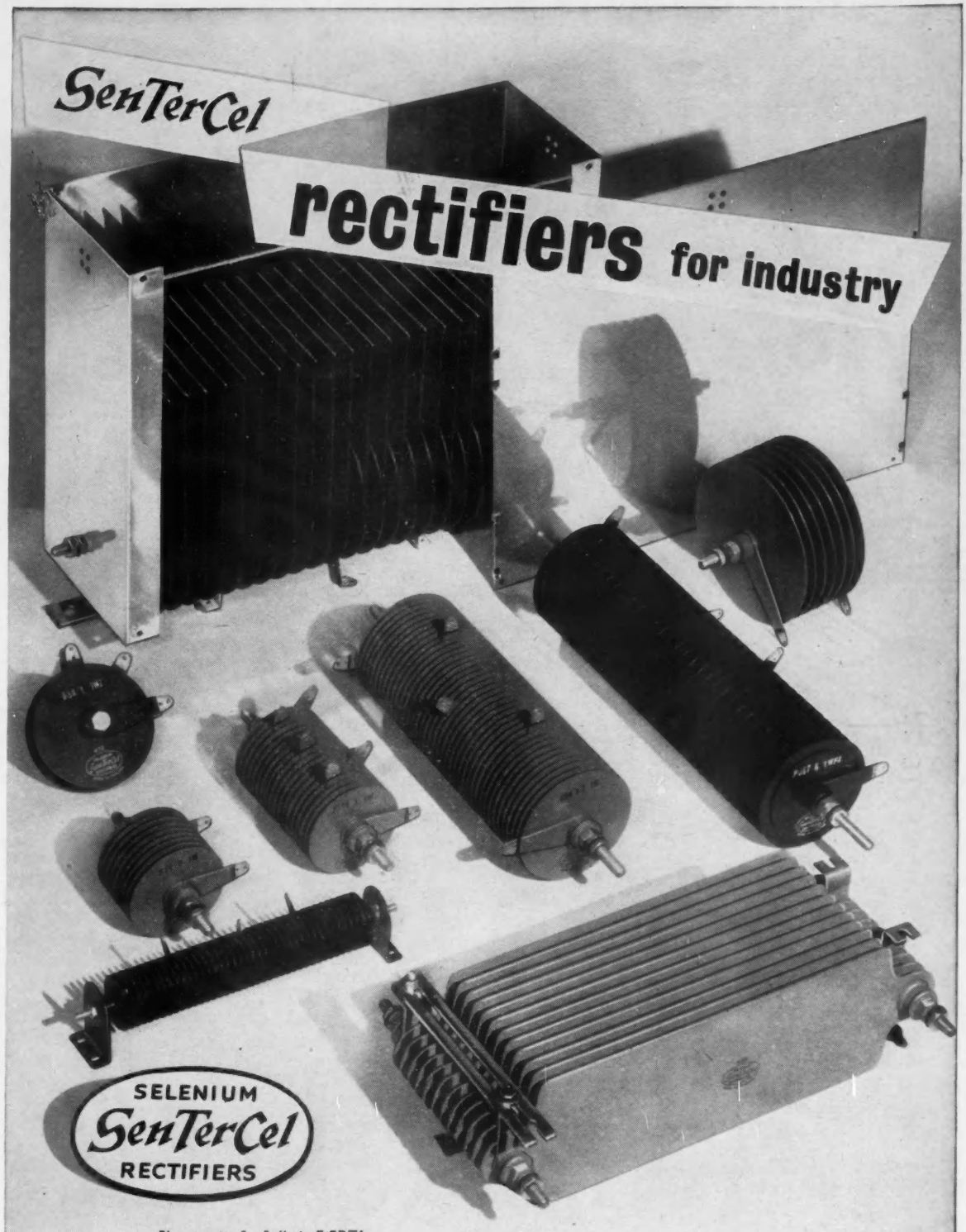

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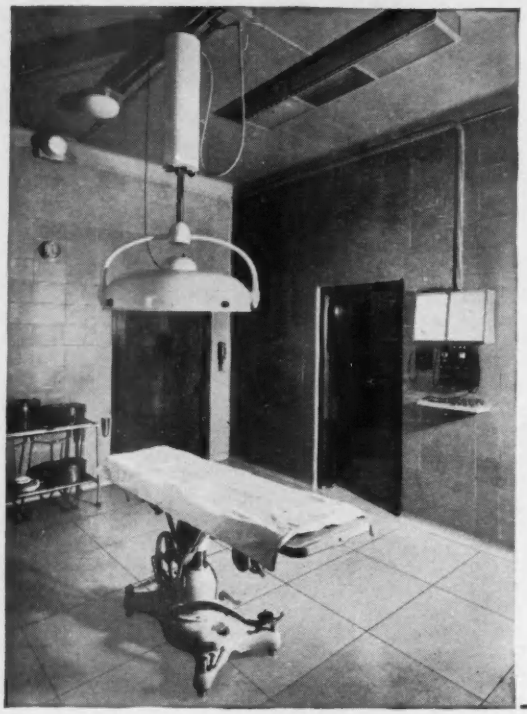

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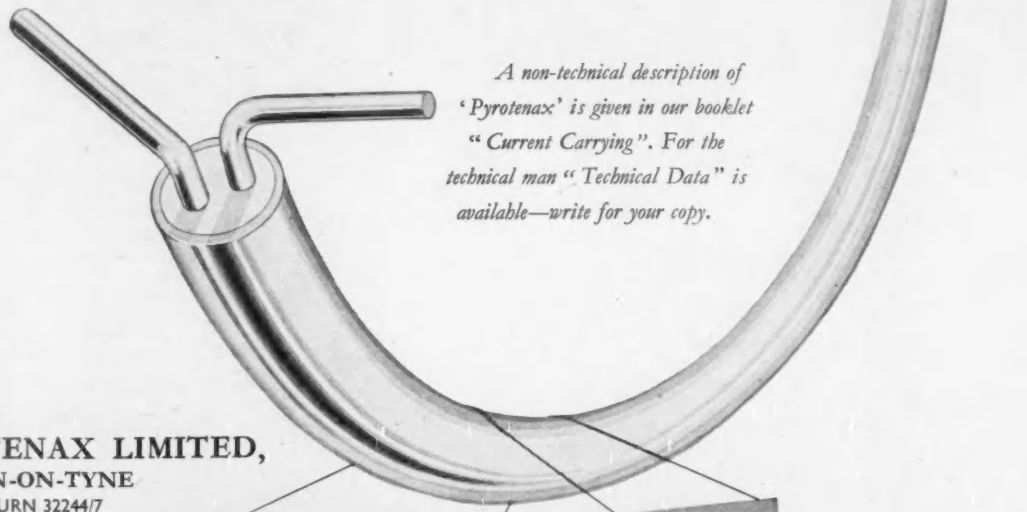

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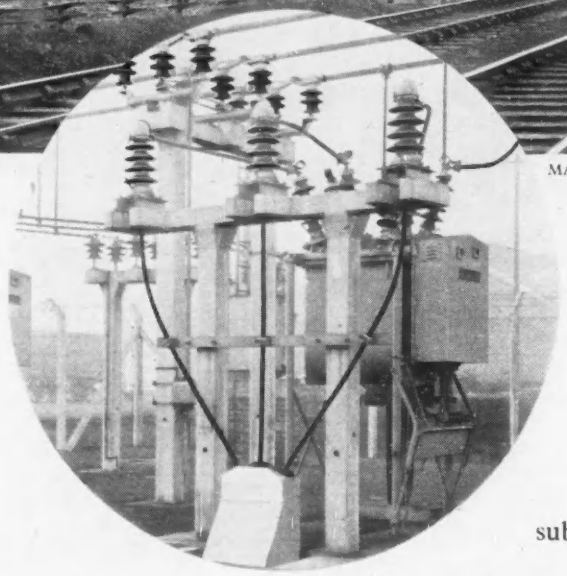

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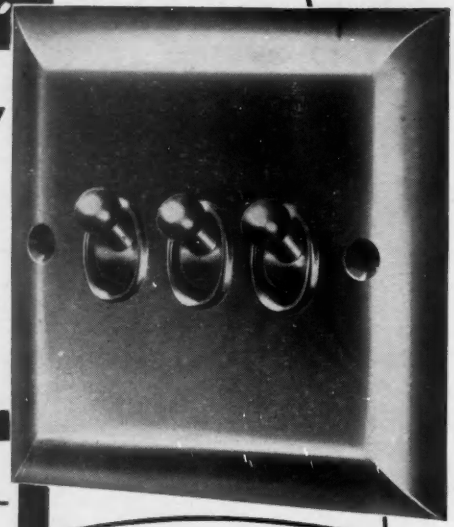

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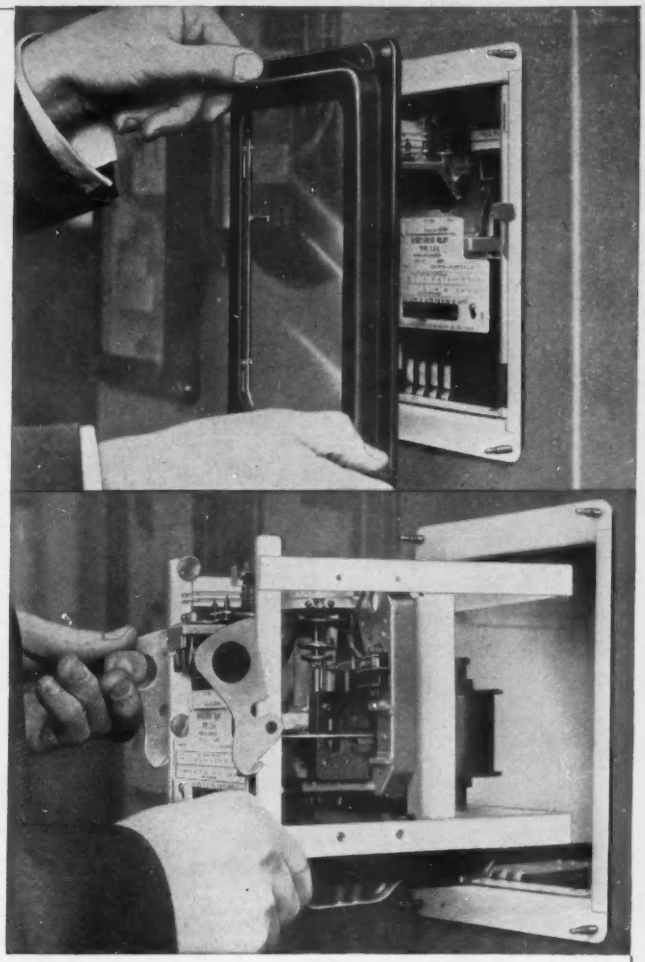

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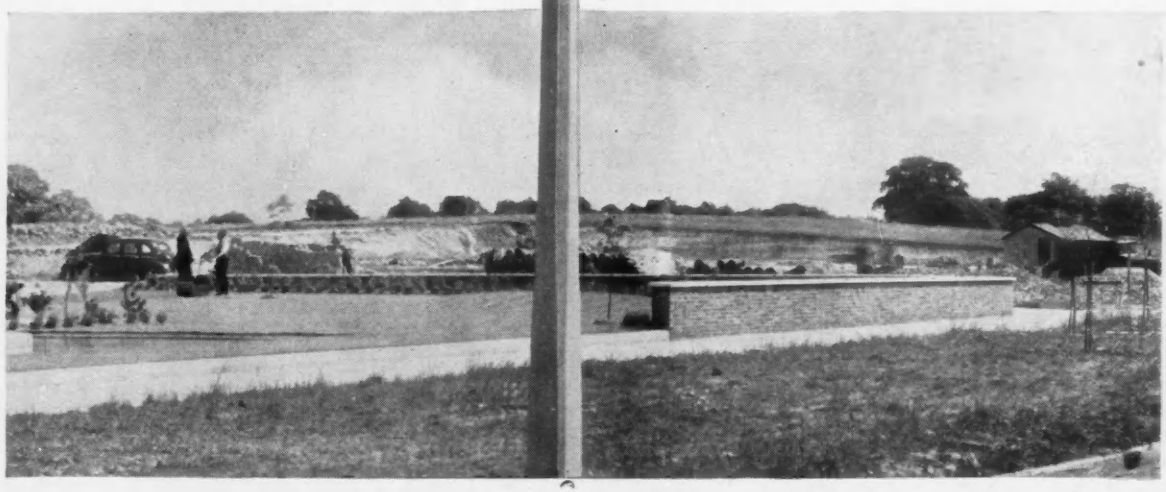

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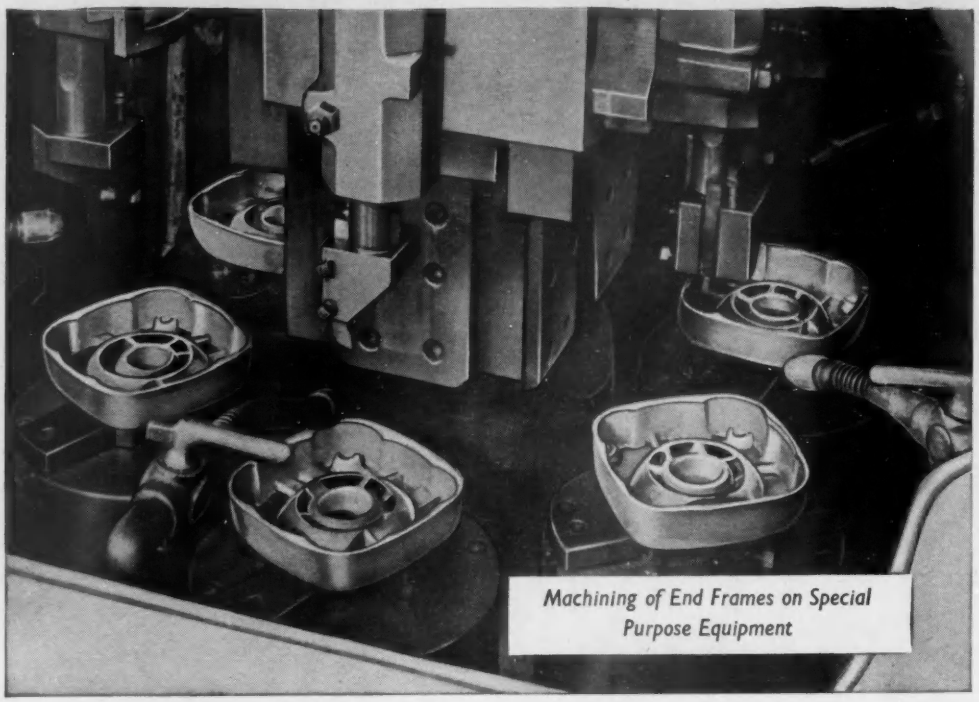

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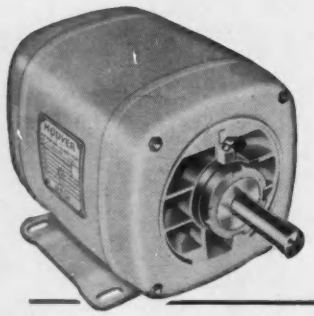

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ELECTRICAL TIMES

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D

SCIENCE AT THE TOP

Ever since its formation in 1947, the Government's Advisory Council on Scientific Policy has devoted most of its attention to the problems of recruiting and educating sufficient scientists and technologists to meet the nation's need. Yet, although this emphasis is again apparent in the Council's seventh annual report, which was published last week, it is made clear as well that increasing attention is being paid to the efficiency with which industry uses the scientific information it has at its disposal. There is no criticism of the largest undertakings: but they do not make up the bulk of industry. Dealing with smaller firms, the Council consider their scientific facilities so slight that they often hardly know what new research is waiting to be exploited in their own specialist field. Even if they are informed to a better degree than this, they frequently suffer from an inability to make the best use of their knowledge. To quote the report, "The assessment of the rate at which new developments can be profitably undertaken is not only dependant on a business sense. It depends even more on an understanding of the scientific and technical factors which are involved." The need, then, is for more men with technical qualifications on the boards of medium sized and small firms, and in top management positions. In another section of their report the Council suggests a possible step forward towards this position: encouragement for more boys and girls to study science for its general educational value. Combined with less intensive early specialisation in science, admittedly requiring some modification of university syllabuses, this might bring about the greater appreciation of the possibilities of science which is second in importance only to the actual output of new scientific work itself.

RAILWAY ELECTRIFICATION

In few British industries is tradition so firmly rooted as in the case of the railways and an ingrained dislike of change is clearly exemplified in the case of electrification. Apart from the Southern Region, with its extensive third rail system, designed essentially for passenger multiple unit rolling stock, virtually no main line electrification exists in this country. Yet it has been proven abroad, time and time again, that electrification can lead to increased carrying capacity on existing tracks and, even more important, to higher revenue. The main complaint has always been that of the high capital cost of the fixed structures and substations. It is seldom pointed out, however, as Mr S. B. Warder did in the Convention on Electric Railway Traction, that much of the cost debited to railway electrification lies in work which would

in any case have been needed. This comes to mind in connection with this week's opening of the Manchester-Sheffield scheme for extensive resignalling and track alterations have proved necessary. Had the line been converted in 1926 when the scheme was first mooted, there can be little doubt that the life of the Woodhead tunnels could have been greatly extended, and even up till 1939 the total cost was estimated at just over £3 m. Now the gross cost is in excess of £10 m.

STATUTORY MAINTENANCE

New Regulations for the use of electricity in coal mines became operative this month, and on a later page we review an official memorandum which has been issued to explain the new requirements. We have commented before on the new recognition which these regulations give to the electrical engineer and the electrician in mining; recognition which should have welcome results in terms of status and authority as well as safety. There is a further section of the Regulations, however, which has an interest extending well beyond mining. Under it, planned maintenance becomes in effect a statutory obligation. A scheme of inspection and testing of all electrical apparatus has to be prepared, and the Inspector of Mines may examine the scheme and call for modification if he considers it in any way inadequate. This is a remarkable advance from the position taken in the Electricity Regulations under the Factories Act, where, as readers of our Industrial Maintenance Special Section have recently been reminded by Mr H. W. Swann, there is only the far less precise requirement that "all apparatus and conductors should be so . . . maintained as to prevent danger so far as is reasonably practicable." It is understandable that special attention should be given to mining, where the results of an electrical accident may be catastrophic: but what is now to be required in this field might be taken as an example of good practice by industry as a whole. Substitution of some formal plan of inspection and test for a harassed "repair on breakdown" policy can make a notable contribution to productivity; and if the scheme is discussed with the Electrical Inspector of Factories, it will certainly be safer to operate. Furthermore, it is likely to emerge from such a discussion improved in other respects as well.

ART IN THE STREETS

Street lighting equipment frequently comes under public attack from those more willing to judge by daylight appearance than by night-time performance. Lamps and lanterns must needs be visible while they are not in use, and everything being equal, none will argue that an aesthetically pleasing form is to be preferred to some badly proportioned or over-decorated design. Indeed, so far as trunk road lighting is concerned, the Government imposes a financial sanction on ugliness: only approved designs of lamp and column are eligible for Ministry of Transport grants in aid of road authority expenditure. The Royal Fine Arts Commission has been for some time the approving body in connection with this arrangement, but this month a change-over to the Council of Industrial Design, first suggested in 1951, has been completed. Both manufacturers and public lighting engineers are likely to welcome the change. Because of its close and continuing association with industry, the Council is more likely than other bodies with æsthetic pretensions, to appreciate both manufacturers' difficulties, and the problem of cost that can intrude so harshly into any attempt to combine artistic acceptability with technical effectiveness. So far as street lighting is concerned, the Council has little but praise for manufacturers, with the exception of those concerned with control gear, whose difficulties it perhaps underrates. It will be of interest to note how this relationship continues, for the Council is extending its attention to other utilitarian structures on public view. Before long it will be influencing local planning authorities on the acceptability of electricity supply feeder pillars and small substation buildings. It seems that the electrical industry needs to keep the Council educated about technical problems.

INTERNATIONAL ALUMINIUM

Aluminium has made a rapid advance in the last few decades in challenging copper as an electrical conductor. Now this electrical bimetallism has received further recognition on the international plane. Amongst the results of the International Electrotechnical Commission meeting in Philadelphia has been an international agreement on a basic value for the resistivity of very high purity aluminium. Backing this up are tentative maximum values for the resistivity of the metal in conditions in which it is more likely to find practical use as a conductor. Establishment of such values on an international basis will, no doubt, have a most useful effect where trade and experiment are concerned.

COMFORT FOR SHOW

Apart from their eighteenth century connection in Galvani's experiments, and the perennial problem of the electric eel, electrical engineering and zoology are sciences which have few meeting points. When animals in captivity have to be displayed most conveniently for study, however, the electrical engineer begins to repay something of his debt to the frog's leg. Birds in a "cage" with no more substantial bars than attractive light sharply in contrast with surrounding darkness which they fear; snakes similarly free from apparent physical restraint, kept at a distance by selective refrigeration of a zone too uncomfortable to cross; these latest refinements in zoo display techniques, adopted at the Antwerp Zoo, are described on a later page in this issue. Even when bars and windows are considered advisable, electricity can still help keep the exhibits well in sight. The latest installation with this useful intent has been completed recently at New York's famous Bronx Zoo. There, careful grading of heating in the reptile house cages is used to lure unsuspecting but comfort loving snakes and lizards to the position where they can be best seen and studied by visitors. In the front of the cage the temperature is just to the liking of the animal concerned; away from there it grows progressively cooler. An electronic monitoring system ensures that these desired conditions are maintained and so keeps both exhibits and visitors happy.

Meteor

Measurements in Rectifier Testing

Departures of Waveform from Sine Wave and smooth D.C. necessitate special Techniques

By R. WELLS, M.I.E.E.*

BECAUSE a rectifier presents a distinctly non-linear instantaneous impedance to the supply source to which it is connected, and because its output can never be perfectly smoothed, the various circuit voltages and currents may depart considerably (depending upon the number of phases, the amount of anode firing delay, and the characteristic of the load) from the sinusoidal or from the straight line form. Quite apart from secondary effects which may influence the accuracy of an instrument (such as the frequency error on the indication of a moving-iron voltmeter), this departure from the pure form gives rise to certain apparent anomalies when an attempt is made to reconcile the various measured quantities, one with another. These apparent anomalies are due to such things as the indication of rectifier-type instruments remaining true r.m.s. values only for pure sine waves, to "power factor" instruments which actually indicate cos ϕ and again therefore are true only for pure sine waves, to the over-simplified rule that in d.c. work the product of voltage and current equals power, and to the fact that not all rectifier loads possess the same power utilising qualities.

It is the object of this article to show, among other things, that provided the correct type of instrument is used, and provided its indication is correctly interpreted, these anomalies may be resolved and satisfactory agreements arrived at, within the normal limits of measurement accuracy.

*Hackbridge and Hewittic Electric Co., Ltd.

A.C. Voltage

Even if we assume that the a.c. supply e.m.f. is sinusoidal at source, the voltage at the transformer input terminals of a loaded rectifier will inevitably be distorted. This distortion is caused by the fact that the current drawn from the supply is not sinusoidal, and its various harmonic components produce harmonic voltage drops across the internal impedance of the supply source and across the impedance of the connecting cables. The complex voltage received by the rectifier will be then the supply e.m.f. with the fundamental voltage drops vectorially subtracted (causing a drop in magnitude but no distortion), and with the harmonic voltage drops vectorially subtracted (causing a drop in magnitude *and* a distortion).

The r.m.s. value of this complex voltage is best measured using a dynamometer-type instrument as at (1) on the diagrammatic key. A moving iron instrument may be used but as mentioned it has a greater frequency error and is therefore not quite so suitable for the purpose.

(Note. The diagrammatic key shows a rectifier operating from a three-phase, three-wire, a.c. supply and feeding a motor load which for the purpose of this article may be considered to be either a shunt or a series machine. All the instruments which are dealt with in the article are shown connected in circuit and will be referred to as numbered).

If a rectifier-type instrument (2) is used, care must be taken to interpret its indication correctly because its deflection is proportional to the average value of the half

A typical mercury arc rectifier bank undergoing test at the manufacturers' works

waves and it is only given an artificial calibration coefficient of 1·11 to make it indicate the r.m.s. value when operating on a pure sine wave. The indication of a rectifier instrument then, when used on a distorted voltage such as that under consideration, is not the r.m.s. value. Its indication however when divided by 1·11 will give the average value of the distorted half-waves and hence the form factor of the voltage may be determined from [(1)/(2)] × 1·11.

A.C. Current

The current on the primary side of a rectifier transformer, as stated, is not sinusoidal. Invariably however, (both in the separate phase windings and in the supply lines) it is an alternating quantity of zero average value over a complete cycle. In view of this absence of d.c. component these currents may not only be measured directly, but they may also be measured by the use of a current transformer without introducing errors apart from those normally inherent in any c.t.

Therefore we may say that whether a current transformer is used or not, the technique for measuring the primary current of a rectifier is the same as already mentioned for the primary voltage, i.e. dynamometer-type instrument (3) for the r.m.s. value, rectifier instrument (4) with indication divided by 1·11 for the average value, and form factor of the current from [(3)/(4)] × 1·11.

A.C. Volt-Amperes and Power

A.C. volt-amperes is a quantity obtained simply from the product of r.m.s. volts and amps as indicated by dynamometer-type instruments. Basically then it will be given by (1) × (3) but in our three-phase example, if we assume balanced voltages but allow for possible unbalanced currents, it becomes $\sqrt{3}$ × (1) × average of three such line instruments as (3).

In measuring a.c. power there is really no choice of instrument type—the usual electro-magnetic wattmeter is essentially a dynamometer instrument and its deflection is dependent upon the product of r.m.s. volts, r.m.s. amps and power factor. Moreover, being ironless, the indication of such a wattmeter is practically independent of wave form, and frequency, and may be used with or without instrument transformers for correctly measuring power with the non-sinusoidal voltages and currents that exist on the primary side of a rectifier transformer. Where the supply is three-phase—three-wire, it is best to use the two wattmeter method because it remains true under all conditions, whether the load imposed on the three lines by the rectifier is balanced or unbalanced. Two such dynamometer wattmeters are shown as (5) and (6) and the total a.c. power will be given by their algebraic sum. Care must be taken not to use the two wattmeter method where the supply is three-phase—four-wire, because it would then only remain true with a balanced load (zero current in the neutral) and seldom will exactly this condition hold on the primary of a rectifier-transformer—particularly at small loads. In such a case it is essential to employ the three wattmeter method—one instrument per phase.

A.C. Power Factor

By definition this quantity is $\frac{\text{Power}}{\text{Apparent Power}}$ where power is measured in watts and where apparent power is the product of effective volts and effective amps. It will be apparent then that the only correct way to determine power factor is to measure these three quantities separately and to carry out the calculation. Where the supply is three-phase, the power factor of each phase may be different, and this makes the overall power factor indeterminate. However, in this case, it is usual to take the value as given by total watts (obtained by either the two wattmeter or the three wattmeter method as appropriate) and by average volt—amperes measured as previously described.

It is very important in rectifier practice to adhere to this basic method of determining power factor for the following reason: when dealing with sinusoidal voltages and currents, but only when, cos ϕ (where ϕ is the phase angle between voltage and current) is numerically equal to power factor. When dealing with appreciably distorted wave shapes as encountered in rectifier practice, this no longer holds good, because whereas the harmonic currents add to the apparent power, they cannot actually carry power, so that the power factor is reduced. On the other hand cos ϕ is not affected by the presence of harmonic currents, as quite obviously we cannot talk about the phase angle between the fundamental voltage, and the harmonic components of current (due to their different frequency) but only between fundamental voltage and fundamental current. It will be found then that in rectifier practice there can be such a difference between power factor and cos ϕ that it becomes very necessary to distinguish between them and to avoid any method which gives cos ϕ when true power factor is required to be determined.

Cos ϕ

To determine cos ϕ, where ϕ is the phase angle between fundamental voltage and current, we have two alternative methods. Firstly, we may use an indicating "power factor" instrument (7) of the induction or wattmeter type. Many of these instruments actually have the scale marked cos ϕ (this is correct), others are marked "power factor" and it must be remembered that the indication is really cos ϕ and will only be power factor on sinusoidal voltages and currents.

Secondly, we may determine cos ϕ by the two wattmeter method when we have

$$\cos\phi = \frac{1}{\sqrt{1+3\left[\frac{W1-W2}{W1+W2}\right]^2}}$$

where W1 and W2 are the two wattmeter indications.

In view of the possible appreciable difference between power factor and cos ϕ it is convenient to have another factor to express the magnitude of this difference. This is known as the distortion factor and numerically it equals power factor/cos ϕ where these quantities are determined as described.

Fundamental Component of A.C. Current

Having determined cos ϕ it now becomes possible to calculate the r.m.s. value of the fundamental component of the a.c. current as follows. As we can say that power factor = Watts / volt-amperes where volt-amperes are measured in terms of the r.m.s. value of the *total complex quantities*, so also can we say that cos ϕ = Watts/volt-amperes where volt-amperes are measured in terms of the r.m.s. value of the *fundamental quantities*. Therefore r.m.s. fundamental amps = Watts/(volts × cos ϕ) provided that we assume the voltage distortion to be negligible by comparison with the current distortion.

Energy

A.C. energy and d.c. energy may both be correctly measured by the usual kWh integrating instruments. The a.c. measurements as at (8) where potential and current transformers may be used if necessary, and the d.c. measurement as at (20).

Transformer Secondary Current

The transformer secondary and anode current is unidirectional but discontinuous, and therefore, because it is not a quantity having zero average value over a complete cycle, it is not possible to correctly measure it if a current transformer is introduced. In this case, then, only "whole current" or shunted instruments may be used, and if the latter, the shunt for preference should be of the non-inductive type. The dynamometer ammeter as at (9) is best for the r.m.s. value, and the moving coil ammeter as at (10) is best for the average value. Where two or more anodes operate in parallel from one secondary phase, the anode current (as distinct from the secondary phase current) is sometimes a little unsteady due to the cathode spot movement causing random variation in the load sharing properties of the parallel working anodes. If this is found to be the case then a hot-wire type of ammeter is the best instrument to use for measuring the r.m.s. value of the current because due to its very slow response to current changes it will give a steady average indication.

The "tong-test" type of clip-on ammeter as at (9A) is also a very useful instrument for measuring secondary and anode currents. Whereas its chief usefulness lies in the ease and speed with which a current balance test can be made (where only comparative accuracy is required) it nevertheless will give a surprisingly accurate indication of r.m.s. value even on this wave form of current. Many of these instruments carry an instruction to subtract a certain amount from the reading for d.c. measurements, but the author has found that for measuring the r.m.s. value of an anode current the actual indication with no subtraction is the more accurate.

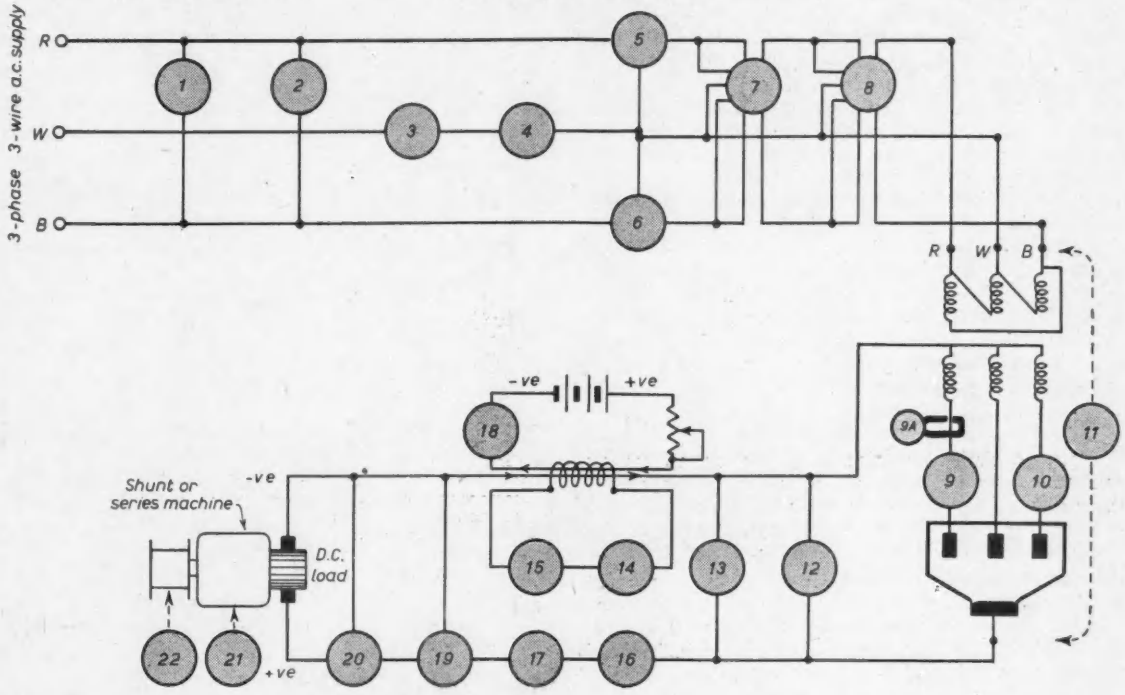
Efficiency and Losses

In principle the most accurate method for the determination of efficiency is to measure the relatively small power losses rather than the input and output powers. For example, suppose we apply a measurement accuracy of 1% to a rectifier of true efficiency 90%, then if the input is measured 1% high and the output 1% low the efficiency would appear to be 88·2%. Conversely if the input is measured 1% low and the output 1% high, then the efficiency would appear to be 91·8% i.e. an error of plus and minus 1·8% may arise. Now in applying the same measurement accuracy of 1% to the task of determining the 10% losses (and the loading at which the measurement is made) the maximum error will only be plus and minus 0·2% in the efficiency.

For this reason the efficiency of a rectifier (or any other piece of apparatus for that matter) should, where possible,

Diagrammatic Key to instruments used in rectifier circuit measurements

Instrument Number	*Type*	*Instrument Number*	*Type*	*Instrument Number*	*Type*
1	Dynamometer Voltmeter.	9A	Clip-on Ammeter.	17	Dynamometer Ammeter.
2	Rectifier Voltmeter.	10	Moving Coil Ammeter.	18	Moving Coil Ammeter.
3	Dynamometer Ammeter.	11	Wattmeter measuring losses (hypothetical).	19	Dynamometer Wattmeter.
4	Rectifier Ammeter.			20	Integrating kWh.
5	Dynamometer Wattmeter.	12	Moving Coil Voltmeter.	21	Wattmeter measuring losses (hypothetical).
6	Dynamometer Wattmeter	13	Dynamometer Voltmeter.		
7	Indicating Cos Ø.	14	Dynamometer Ammeter.	22	Wattmeter measuring output (hypothetical).
8	Integrating kWh.	15	Rectifier Ammeter.		
9	Dynamometer Ammeter.	16	Moving Coil Ammeter.		



be determined by the summation of losses method. Now whereas there is much of interest in the techniques employed for the measurement of rectifier losses, their description is not considered within the scope of the present article and reference should be made to B.S.S. 1698:1950 for details.

If it is not convenient to determine efficiency by the summation of losses method (such as a test on site for example), and it is decided to carry out an input/output measurement, then it is essential to measure the output by means of a wattmeter. By this means the difference is indicative of the separately-measured losses as shown hypothetically by wattmeter (11)—at least within the accuracy limits as described above—but for reasons which will be given later, the same is not true if the output power is measured by moving coil voltmeter and ammeter, or even by dynamometer voltmeter and ammeter.

D.C. Voltage

As stated, the d.c. voltage output from a rectifier is not perfectly smooth. This means that it consists of an average or d.c. component with an a.c. ripple component superimposed. A moving coil voltmeter as at (12) will indicate the d.c. component of this complex voltage because whereas its torque is directly proportional to the instantaneous voltage, the inertia of the moving parts prevents the indication from following the undulations with any fidelity and only the average value is recorded. A dynamometer-type voltmeter as at (13) will indicate the r.m.s. value of this complex voltage and if the r.m.s. value of the ripple component is required it may then be calculated as follows:—

R.M.S. value of ripple component =
Square root of [(R.M.S. value of complex total)^2 − (Average value of complex total)^2] = $\sqrt{(13)^2 - (12)^2}$.

D.C. Current

As with d.c. voltage, so also with d.c. current. A moving coil ammeter as at (16) will indicate the average value, a dynamometer ammeter as at (17) will indicate the r.m.s. value, and the r.m.s. value of the ripple component may be determined as above. It is of interest to note that if a current transformer is used in a circuit carrying a rectified d.c. current and the average value of the current is backed off by means of a smooth counter current (measured by moving coil ammeter as at (18) and adjusted to equal the indication of (16)) so as to avoid static magnetization of the core, this ripple component may be directly measured by means of an a.c. ammeter connected to the current transformer secondary. By this means a dynamometer instrument as at (14) will indicate the r.m.s. value of the ripple, and a rectifier instrument as at (15) will indicate the average value times 1·11 of the ripple—a moving coil instrument would of course give zero indication—so that it becomes possible to determine the Form Factor of the isolated ripple component $\left(\frac{(14)}{(15)} \times 1{\cdot}11\right)$.

(Note. A similar technique (but backing off the d.c. component with a battery) may be used in connection with the ripple voltage measurements of rectified d.c. but it is not shown on the diagrammatic key).

This condition arises if an attempt is made to measure the r.m.s. value of a rectified d.c. current by means of a multi-purpose instrument (employing internal current transformers, rectifier and moving-coil element) with the range switches set for a.c. current. Here the indication is not the r.m.s. value of the current but only a somewhat inaccurate indication of the ripple average value × 1·11. In view of this, great care must be taken in the use of such instruments on rectifier circuits as it is quite easy to be mis-led if the significance of the indication is not fully appreciated for the condition of use.

D.C. Power

A perfectly smooth d.c. voltage or current has only one value, its instantaneous value at any moment, its average value, and its r.m.s. value, are all one and the same thing. Therefore, because of this numerical equality, we have the simple teaching that in d.c. working the power in watts is the product of volts and amps, and because the result is the same we do not specify whether it is average or r.m.s. values that we are multiplying. Again, the resultant power is also smooth and presents no difficulties of measurement or definition.

In rectifier practice the d.c. voltages and currents are never perfectly smooth (although with a large number of

Quantity	Determination. Numbers in parenthesis apply to instrument readings
R.M.S. value of a.c. voltage.	(1)
Average value of a.c. voltage.	(2) ÷ 1·11
Form factor of a.c. voltage.	(1) ÷ [(2) ÷ 1·11]
R.M.S. value of a.c. current.	(3)
Average value of a.c. current.	(4) ÷ 1·11
Form factor of a.c. current.	(3) ÷ [(4) ÷ 1·11]
R.M.S. value of fundamental component of a.c. current.	[(5) + (6)] ÷ [(1) × (7)]
A.C. volt—amperes ...	$\sqrt{3} \times (1) \times (3)$
A.C. power	(5) + (6)
A.C. power factor ...	[(5) + (6)] ÷ ($\sqrt{3} \times$ (1) × (3)]
A.C. cos ϕ	(7) or $1 \div \sqrt{1 + 3\,\frac{(5)-(6)}{(5)+(6)}}^{\,2}$
A.C. distortion factor ...	$\frac{[(5)+(6)] + [\sqrt{3} \times (1) \times (3)]}{(7)}$
A.C. energy	(8)
R.M.S. value of secondary current.	(9) or (9a)
Average value of secondary current.	(10)
Average value of d.c. voltage.	(12)
R.M.S. value of d.c. voltage.	(13)
R.M.S. value of ripple component of d.c. voltage.	$\sqrt{(13)^2 - (12)^2}$
Average value of d.c. current.	(16)
R.M.S. value of d.c. current.	(17)
R.M.S. value of ripple component of d.c. current.	$\sqrt{(17)^2 - (16)^2}$ or (14)
Average value of ripple component of d.c. current.	(15) ÷ 1·11
Form factor of ripple component of d.c. current.	(14) ÷ [(15) ÷ 1·11]
Total power output ...	(19)
D.C. component of power	(12) × (16)
Ripple component of power.	(19) − [(12) × (16)]
Ripple power factor ...	$\frac{(19) - [(12) \times (16)]}{[\sqrt{(13)^2 - (12)^2}] \times [\sqrt{(17)^2 - (16)^2}]}$
D.C. energy	(20)
Rectifier efficiency ...	(19) ÷ [(5)+(6)] or (19) ÷ [(19)+(11)]

phases and zero anode firing delay the difference is negligible), and since instantaneous power equals instantaneous voltage times instantaneous current this gives rise to an unsmooth power wave. This undulating power has itself got various values such as maximum, r.m.s., average, and minimum, and this has given rise to such expressions as "effective power" (defined as the average value of the power wave), and as "mean power" (defined as the product of mean or average voltage and mean or average current). These expressions can cause confusion because "effective power" could mean the r.m.s. value of the power wave. On the other hand they are sometimes taken as being identical because the first is the average or mean of the undulating power wave, while the second is the product of the average or mean voltage and current. In actual fact they are not identical, the first is the real total power that would be conveyed by unsmooth voltages and currents, and it is a value which can only be measured by a wattmeter. The second is only a component of the total power and of course can be determined by moving coil voltmeter and ammeter. The first can only be measured by wattmeter (not by the product of r.m.s. volts and amps) because the ripple components are subject to a power factor effect. With in-phase voltage and current ripples the a.c. power component is at a maximum and then r.m.s. volts times r.m.s. amps will equal total power. With voltage and current ripples in quadrature the a.c. power component is zero and average volts times average amps will equal total power. In all cases then average volts times average amps is the d.c. power component, wattmeter indication gives total power, and wattmeter indication minus the products of average volts and average amps gives the ripple power component.

From the foregoing it will be appreciated that the power output of a rectifier can only be measured by wattmeter as at (19) if the result is to be correct for all conditions.

The Load

The total power received by the load is the same as the total rectifier output (neglecting cable losses etc), as correctly measured by wattmeter. Now this total power can only be put to full use (as far as the efficiency of the load itself will allow) in loads which can make use of the a.c. component as well as the d.c. component, i.e. loads which depend upon the square of the current and which in principle at least could also be operated on a.c.—such as series motors and resistance loads. In other cases, such as battery and other electrolytic loads, and also shunt motors, the load cannot make use of all the power it receives from the rectifier—it can in fact only use the d.c. component while the power of the ripple component is completely lost and only adds on to the normal internal losses of the load. The load then receives an amount of power equal to the wattmeter indication, but it only usefully uses an amount of power equal to average volts times average amps—the difference being uselessly dissipated as additional heating losses over and above the value they would have with a perfectly smooth current. We have then, in this class of load, something akin to power factor and which may be defined as:

(Power used in the load plus I^2R losses at unity Form Factor) ÷ (Power output from rectifier) = (average volts × average amps)/(Wattmeter Indication).

Power Relationships

In conclusion it is proposed to give the overall power relationships for both types of load using the diagrammatic key numbers.

The rectifier total power input in both cases is given by the algebraic sum of (5) and (6), the rectifier total power output by (19) and the difference will be equal to (11).

The mean or d.c. component of power to the load is given by (12) × (16) and in the case of a shunt machine its power output (22) will equal (12) × (16) minus (21) the machine losses.

The total power input to the load is given by (19) and in the case of a series machine its power output (22) will equal (19) minus (21) the machine losses.

The table given above, using instrument numbers as given on the diagrammatic key, summarizes and expands the various measurements which may be made.

Acknowledgment

The author's thanks are due to the Hackbridge and Hewittic Electric Co., Ltd., for permission to publish the information contained in this article.

Scientific Policy Reviewed

A REVIEW of the post-war decade, with particular reference to the country's scientific development is the outstanding feature of the Seventh Annual Report of the Advisory Council on Scientific Policy, which was published last week. The Council describes itself as being concerned "not with administrative matters, but with the strategy of scientific affairs," which is today a part of national policy.

During the period 1947 to 1953, the proportion of the total university population in pure and applied science departments only rose from about 31 to 33%, and present indications are that these departments are doing no more than maintain their student numbers. Numerically, the position of the technical colleges is more encouraging. Numbers of O.N.C. and H.N.C. passes have risen considerably, and are now about three and six times pre-war levels respectively.

The report gives close attention to science teaching at schools. Persuading boys to stay at school until the age of university entrance is considered the most important single measure that could affect the supply of science undergraduates (including technologists). There is a view, however, that if an increase in the university population were to take place at the expense of the numbers of relatively early school-leavers who continue part-time studies and eventually gain H.N.C. or an external degree, then the country would be poorer for the change. In connection with school work, it is considered essential that a solution be found to the problem of the science teacher.

The Advisory Council suggests that there might be some advantages to be gained from avoiding too early specialisation in schools, with science students knowing more of the humanities and arts specialists having more appreciation of science subjects than at present. The Council breaks new ground in the present report by advocating that some of the more talented boys and girls who now take up the humanities should be attracted to science. They specifically state that an education in science is just as likely to provide a student with intellectual stimulus as an education in the classics or history.

Later in their report the Council give attention to the scale of Government sponsored research. Here they welcome the reorganisation of D.S.I.R. finances on a quinquennial basis. They also endorse earlier suggestions for the expansion of national scientific libraries.

Trans-Pennine Electrification Complete

MANCHESTER—SHEFFIELD MAIN LINE SECTION NOW IN OPERATION

FOLLOWING the opening in June of the Woodhead tunnel by the Rt. Hon. Lennox-Boyd, Minister of Transport and Civil Aviation the final stage in the rail electrification scheme between Manchester and Sheffield took place on Tuesday last, when with all due ceremony the steam locomotive was removed from a special train at Sheffield, an electric tractor substituted, and a select party of guests travelled from Sheffield to Manchester.

Thus, the main part of the scheme, first approved by the directors of the L.N.E.R., reached fulfilment, and electrical haulage of passenger and heavy goods trains over the difficult section of line across and through the Pennines became an accomplished fact.

Details of the scheme have been published before in our issues, particularly in February 1950 and February 1952, but on this notable occasion, it may be worth while to recapitulate some principal features of the scheme. The first part, Wath-Dunford Bridge, was completed in 1952, and since that time electric locomotives working on the 1,500 V d.c. overhead system have been engaged in hauling the heavy coal trains up the bank from the local collieries to Penistone. With the present opening Part 2 of the scheme has reached its final stage and the whole route from Sheffield to Manchester has been electrified. Parts 3 and 4 involve the electrification of Sheffield to Barnsley and Fairfield Junction to Manchester.

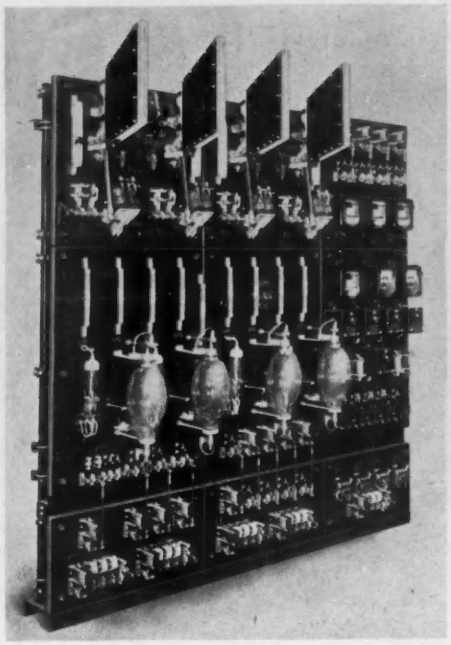
A total of 65 electric locomotives will be used for the scheme of which 58 will be of the Bo and Bo type. These are rated at 1,360 h.p. at 56 m.p.h., with a one-hour rating of 1,868 h.p. at 45 m.p.h. The remaining units will be Co and Co with a rating of 2,298 h.p. at 46 m.p.h. and one-hour rating of 2,490 h.p. at 44 m.p.h. Eleven traction substations, fitted with Bruce-Peebles continuously-pumped rectifiers supply d.c. to the B.I.C.C. catenary system, and a.c. power is supplied to the substations at 33 kV through Henley's cables. The transformer and switching sections of the substations are equipped with Reyrolle circuit-breakers and isolators, who were also responsible for the d.c. switchboards in the substation and track sectioning cabins. The d.c. switchgear, however, was provided by British Thomson-Houston Co., who, in addition to 139 d.c. high speed circuit-breakers and control cubicles have also supplied four electronic regenerative braking equipments. These automatically ensure that in the event of a rise of d.c. voltage due to heavy braking on the locomotives, current can be dissipated in resistance banks, the number of banks connected being automatically selected by the equipments.

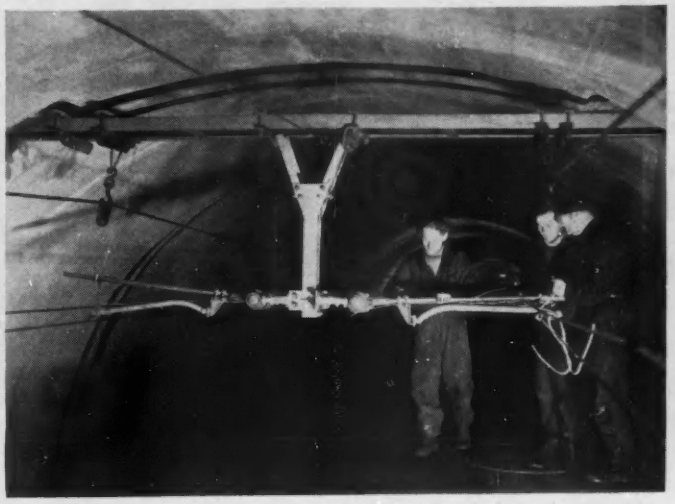
The whole of control of the substations and associated electrical equipment is centralised at Penistone, the main contractors for this section of the work being Bruce Peebles, with Standard Telephones and Cables responsible for the supervisory system. At the moment this system is capable of handling 23 remote stations, consisting of 11 substations and 12 track circuiting stations, but the control desk and equipment is designed so that up to 36 stations may be accommodated.

Our heading picture shows a Class EM2 Co-Co Locomotive No. 27000 hauling a passenger train near Crowden

Background to the Scheme

It is probably of some interest to look into the background of this, the largest main-line electrification scheme on 1,500 V d.c. in the country, and it is possibly unfortunate for the country as a whole that so many factors were involved which indicated that electrification was desirable. First there was the problem of the Woodhead Tunnel itself. The new tunnel is a complete replacement for the two single-track tunnels built in 1845 and 1852. These, due to the ever increasing traffic and the difficulty of maintenance ultimately passed the "point of no return" when deterioration was advancing at too great a rate for any known system of maintenance. Consequently it became essential to drive a further two-track tunnel and, as much of the deterioration in the old tunnels was due to the fumes and smoke from the steam locomotives, to ensure a good life, electrical working became most desirable.





The B.T.H. automatic electronically operated regeneration equipment is on the left. Above workmen adjust the catenary in the Woodhead tunnel (B.I.C.C.)

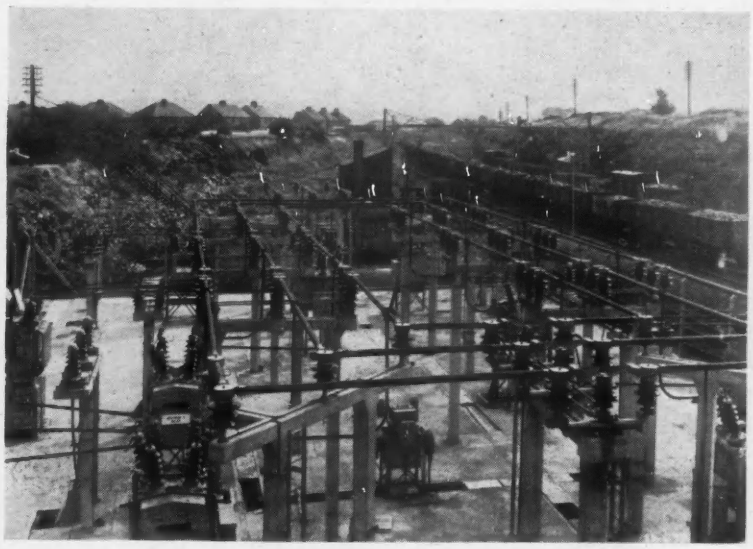
Second were the intense gradients on the system—as high as 1 in 40 on the Wath section where four steam locomotives were required for a single coal train. Here the high short-time overload ratings of electric locomotives could be utilised to maximum advantage. Third was the extremely high traffic density, another factor where experience with electric locomotives has shown that much easier working can be carried out. Any one of these factors might well have been a justification for electrification, but all three together presented a wellnigh overwhelming case.

Much of the design work on the civil side had to be based on the assumption that heavy subsidences would occur due to mining operations—and in fact, even over the past few years this assumption has proved justified. Certain over-bridges, for example, have been rebuilt with pre-stressed concrete beams and arrangements made for jacking them up to maintain overhead clearances. A similar technique has been adopted for the catenary supports so that, electrically and mechanically, the correct clearances between contact wire and rail can be maintained with a minimum of effort and cost. The same considerations applied even to such items as supply cables. In the subsidence areas, these are carried on long reinforced concrete posts with the cables themselves contained within asbestos-steel troughing carried on these posts. By this method the cable slack can be taken up as needed.

Manchester—Glossop

A section of suburban electrification in the Manchester area was also undertaken in connection with the general scheme. A section of this follows the same route as the main line from Manchester to Sheffield as far as Glossop. Passenger rolling stock for this section, now operating, consists of multiple rolling stock fitted with G.E.C. electrical equipment. Eight train units, each unit comprising a motor coach, a trailer coach and a driving trailer, were ordered. The motor and trailer coaches were supplied by the Metropolitan-Cammell Carriage and Wagon Co., Ltd., and the driver trailer coaches by the Birmingham Railway Carriage and Wagon Co., Ltd.

At the commemorative luncheon the toast "Success to the Electrification Scheme" was proposed by Sir William Walker. Sir Brian Robertson, who spoke later, said it was the aim of the British Transport Commission to equip the railway system to the highest standard of modernity.



One of the outdoor 33 kV substations at a rectifier station (Reyrolles)

A 275 MW Set for Philadelphia

A 275 MW turbo-generator unit, the largest ever ordered, is to be built by the Westinghouse Electric Corporation for the Philadelphia Electric Co. A steam generator, to be made by Combustion Engineering Inc., will supply steam to the turbine at 5,000 lb/sq in. and 1,200° F. Initially, however, the set will run at 1,150° F, at which the plant heat rate is expected to be 8,400 B.Th.U. per kilowatt.

The tandem-compound, four-cylinder turbine will operate at 3,600 r.p.m. utilising triple-flow exhaust and double reheat to 1,050° F. The "super-pressure" cylinder exhausts at about 2,400 lb/sq in., and the second element combines both high pressure and first reheat pressure turbines in a common casing. Third is a cylinder combining intermediate pressure and single-flow low-pressure turbines and the final element is a conventional double flow l.p. turbine exhausting at about 1·5 in. Hg.

The condenser is a single-pass radial flow type with a cooling surface of 105,000 sq ft. Nine stages of feed water heating are contemplated to give a final temperature of about 565° F boiler-feed supply. Westinghouse feed heaters with a total area of 31,000 sq ft will be used.

The generator rated at 352 MVA, 24 kV, will be self-ventilated with shaft-mounted fans and will employ hydrogen inner cooling of rotor and stator conductors, with a gas pressure of 45 lb/sq in. It would be impossible to build a single generator of this size without the use of inner-cooled conductors. Excitation is provided by separate motor-driven d.c. generators, and voltage regulation will be automatic using magnetic amplifiers.

For steam generation, a once-through boiler of the C.E. Sulzer Monotube type will be used with forced circulation. It will be a twin-furnace design, with tangential-firing and reheat steam temperature control by means of tilting burners. At rated load the primary steam flow will be 1,540,000 lb/hr, and in the first stage of reheat, steam at 1,050 lb/sq in. will be reheated to 1,050° F. In the second stage, steam at 250 lb/sq in. will also be reheated to 1,050° F. About 65% of the total heat transfer will take place in the superheater and the reheaters. To accomplish this, radiant-wall type superheating surfaces will supplement the conventional suspended superheater and reheater sections. Three regenerative type air preheaters are to be installed.

Conventional combustion controls will be employed. For steam and water flow and temperature control in the boiler, Sulzer automatic controls of the oil-hydraulic type are to be used.

Escom's Good Year

DURING the sixteen months ended 30th April last, new generating plant with an aggregate rated capacity of 230,500 kW was installed in the various undertakings of the Electricity Supply Commission of South Africa. Yet despite this noteworthy progress in installing new plant, unavoidable delays have still retarded the programme of construction of new stations and extensions to others.

On the Rand Undertaking in particular, a severe strain has been imposed on the Commission's resources by the expansion of gold mining and the rapid development of the uranium industry together with the requirements of associated industries and local authorities. Consequently it has not been possible to relax the restrictions on consumers' maximum demands in this area. A re-assessment of the gold mining industry, including uranium production, for the next few years has revealed the urgent necessity for the provision of additional power, and steps have been taken to site and plan a new station. In Natal growth of load on the Durban undertaking necessitates the provision of an additional 30,000 kW turbo-generator and additional boiler plant at Umgeni power station.

Increase of 8%

The annual report of the Commission, just published, shows that during the year ended 31st December last 9,441·9 million units were generated in the Commission's power stations and over 8 million tons of coal were consumed. Total sales of electricity, steam and compressed air were 8,732·2 million units, an increase of 8% over the previous year's total.

Large users, such as the South African Railways, mines and industries, purchased nearly 80% of the Commission's output. The growth of the requirements of local authorities is illustrated in a striking manner by the fact that the sum of the maximum demands of local authorities supplied in 1953 was about 400,000 kW. The comparative figure for 1945 was about 160,000 kW. In this period the Commission has incurred capital expenditure of between £10 millions and £12 millions to meet the needs of local authorities connected to its systems, and if the rate of growth of municipal undertakings is taken at 8% per annum, the Commission's contingent responsibility is calculated at more than £1½ millions per annum for additional generating plant.

Rural Expansion

Steady progress has also been made with the provision of electricity to rural areas and during the four years ending 31st December, 1953, the Commission connected 2,882 rural consumers of whom 1,094 were farmers. In 1953, 143 farms were connected. According to the report it has been found uneconomic to supply large farms. The best farming schemes are applicable in areas where there are numbers of small farms and where power is needed for farming purposes in addition to domestic purposes. Escom's policy has always been and will continue to be, to supply farmers in all cases where funds and technicians are available and the supply is economically and technically practicable.

As was previously foreshadowed, the Commission was compelled to increase electricity charges in practically all of its undertakings to offset rising costs of coal, new plant installed, railage and other services. The increased revenue so obtained has enabled the Commission to convert a deficit of £418,282 at the end of 1952 into a small surplus of £931 at the end of 1953. It will, however, be necessary to further increase tariffs when new plant under construction or on order, purchased at the high prices ruling at the time, is brought into commission, it is stated.

Capital expenditure on plant and works on the various undertakings has increased by £49 millions during the past three years. Of this amount nearly £23 millions were spent in 1953 which brought the total capital expenditure at 31st December, 1953, to £109,369,537. Expenditure on capital account will amount to approximately £185,000,000 on completion of all the works to which the Commission is committed and on projected works.

Standardisation's Golden Jubilee

I.E.C. CELEBRATES 50 YEARS ACTIVITY AT PHILADELPHIA MEETING

The President welcomes delegates

FIFTY years of progress in international standardisation in electrical engineering were celebrated in Philadelphia, Pennsylvania, last week, when one day of the International Electrotechnical Commission was devoted to addresses and commemorative meetings. These meetings were held under the chairmanship of Dr H. S. Osborne, President of the I.E.C. (seen above—formerly chief engineer of the American Telephone and Telegraph Co.). Greetings to the delegates from the American Government were delivered by Mr C. E. Saltzman (Under Secretary of State for Administration), on behalf of General W. Bedell Smith, and amongst senior members of delegations who delivered addresses were the Rt Hon Viscount Waverley (United Kingdom), Mr P. Ailleret (Electricité de France), Dr L. A. Du Bridge (President, California Institute of Technology), and Dr H. Sterky (Director General, Swedish Telecommunications).

In his address, General Bedell Smith recalled the meeting of the International Electrical Congress in St. Louis in September 1904, as part of an Exposition held to celebrate the Louisiana purchase. At this was born the International Electrotechnical Commission. After dealing with the effect of science on warfare, the General went on to emphasise how much can be done by organisations such as the I.E.C. to bring about better understanding between nations and people. Its activities were cosmopolitanism in the best sense.

Lord Waverley, in his address, reviewed the instruments of official international economic co-operation which had come into existence since the war, saying that they formed an impressive list, and were powerful aids, if properly used.

The work of the I.E.C. would have results not less important than that of Government bodies. To secure agreement was a matter of hard bargaining not unlike that which applied in inter-governmental organisations, but there was the advantage in I.E.C. of common professional aims and basic understandings. Members had a great opportunity towards bringing about "world in tune." If the leaders of industry in all countries would back the efforts of their technologists by more formal international agreements, spectacular advances in truly effective international co-operation would be possible.

A typical technical committee meeting at Philadelphia: I.E.C. technical committee 25 on letter symbols and signs in session. Around table, clockwise, starting at left foreground, Prof A. Damianovitch and Prof P. Milianitch (Yugoslavia) Prof R. O. Kapp and Col. J. Reading (U.K.), K. E. Anspach, C. Elwen) (U.S.A.), C. E. Hilton, (Asst. Secy.) Prof H. M. Turner (U.S.A.), M. K. Landolt (Switzerland: Chairman), H. P. Westman (U.S.A., Secretary) J. J. Smith, Dr C. Chambers and F. G. Brainerd (U.S.A.). Backs to camera, from right: Prof U. Stille (Germany), Prof L. Brison (Belgium), Dr F. Foa (Israel), G. Darrieus (France), Prof F. A. Dahlgren, Prof W. Bahler and R. Vermeulen (Netherlands) and P. L. Alger (U.S.A.)

Dr P. Dunsheath, who is treasurer of the I.E.C., and Mrs Dunsheath chat with L. Ruppert, Secretary of I.E.C., at the Welcoming Reception

In the concluding section of his address, Lord Waverley emphasised, in particular, the value of international co-operation in research. He was certain that the I.E.C. would in future play an increasingly important part in human progress, and that it would provide one of the corner-stones of international economic co-operation with the aim of world prosperity and peace.

More than 1,000 delegates and their wives from twenty countries have been attending the Jubilee meeting. The British delegation, with 96 members, was second in size only to that of the U.S.A. The meetings began in hot sunny weather on 1st September, when the President of the U.S. National Committee of I.E.C., Mr R. C. Sogge (General Electric, Schenectady), made a brief welcoming speech to all delegates, making special mention of the Japanese, who, with a delegation of ten, were making their first appearance since the war. After that, the fifty or so technical committees and sub-committees scheduled to confer during the meeting got to work. In the evening of 2nd September, there was a welcoming reception for delegates.

Amongst the technical committee presidents were the following members of the U.K. delegation: Messrs C. A. Martin (dimensions of motors and rotating machinery), J. H. C. Spinks (classification of insulating materials), B. Pochobradsky (steam turbines), C. Ridpath (aluminium), G. O. Watson (electrical installations on ships), F. J. Hawkins (lamp caps and holders), R. W. Sanderson (primary cells and batteries), J. S. Cliff (lightning arresters), and T. E. Goldup (electronic tubes and valves).

Amongst the important agreements reached at Philadelphia was one concerning a basic international standard of resistance for aluminium. Canada, France, Germany, India, Sweden, the U.K. and the U.S.A. were represented on the committee concerned. The basic value agreed upon applies to very high purity aluminium, and is 1/37 (i.e., 0·027027) ohm-mm square/metre. In addition to agreement on this basic standard, there was tentative approval for a value of 0·028264 ohm-mm square/metre as a maximum resistivity for h.d. aluminium wire. There is to be a six months' trial of this value before approval is finally given.

On a basis of these values, the maximum resistivity value for aluminium bus conductors was set at 0·0290 ohm-mm square/metre. There was also agreement on the basic standard mechanical values for galvanised steel wire as used in s.c.a. conductors.

Another committee to reach an important agreement was that on electric traction equipment. It was concerned with a new code of rules for measuring the performance of railway locomotive electric motors, and that agreed was further approved by the Mixed Committee on Electric Traction Equipment. Most important of the results is a revision of a 1950 publication "I.E.C. Rules for Electric Traction Motors." This revision provides up-to-date rules for measuring the torque of motors and the commutation,

Electrical Engineering in Coal Mines

NEW regulations covering the installation, testing, and maintenance of electrical and mechanical plant in coal mines came into operation on 1st September last. (See ELECTRICAL TIMES, 1st April, 1954.) In a memorandum issued by the Ministry of Fuel and Power, the intention behind these Regulations is explained in some detail.

There are two fundamental requirements: that there shall be a man in charge of the electrical plant and a man in charge of the mechanical plant at every mine, with assistants if necessary; and that the men in charge and their assistants shall be competent to carry out their duties as specified in the Regulations. In connection with the requirement that the manager of the mine shall appoint a competent person to these positions, it is emphasised that it will be the duty of the manager to decide whether the person is competent. Minimum technical qualifications are laid down in the Regulations, but it will not be sufficient for the manager to rely on the fact that persons he proposes to appoint have the appropriate qualifications. Each person must be judged against his particular post.

At small mines, where the only electrical apparatus is miners' lamps and battery charging equipment, and this is normally maintained by the lamp manufacturers, it will be in order for the manager to appoint a competent representative of the manufacturers to act as electrician for the purposes of the Regulations.

The Memorandum throughout mentions both electrical and mechanical engineers. For the purpose of the remainder of this article, however, comment will be confined to those sections which relate solely to electrical engineers.

Electricians are specifically required to supervise or themselves carry out the installation of all plant, its examination and testing after installation and reinstallation, and its maintenance in safe working condition. They also have to carry out a systematic testing and maintenance scheme. The mine manager is required to see that such a scheme exists, and it is intended that it should provide the basis of the routine work of the electricians. In addition to providing for the examinations and tests required by the Coal Mines Act, 1911, the statutory scheme should provide for special examinations and tests for all types of apparatus, and should indicate their precise nature and scope, and the intervals at which the tests should be carried out. The memorandum suggests that the scheme should pay particular attention to the following details as regards electrical plant: external examination, including housing and means of support; insulation resistance; examination of working parts, enclosures and protective devices; conductance of earthing conductors, metallic screens of cables; voltage test of plant required at surface.

Besides fully qualified electricians, the manager can appoint linesmen, armature winders, etc. to carry out duties of limited scope.

In connection with the qualifications set out under the Regulation, the Memorandum gives a detailed explanation of the arrangements to protect men in post by the issue of service certificates. Rules for the qualifications required by the Mining Qualifications Board are being drafted.

around the trade

by Peregrin

MEMBERS of the E.C.A. must be looking wistfully across the sea to Ireland, and wondering if the nostalgic ballads about the Emerald Isle are true after all. Electrical contractors there are certainly having "A little glimpse of Heaven" at the moment, judging by the reports of unprecedented co-operation between them and the Eire Electricity Supply Board. Contractors will even participate in hire-purchase sales, a privilege with immense possibilities for those who know how to take advantage of it. Whoever is responsible for this happy outcome is to be congratulated, for it could only have been achieved by patient effort and infinite goodwill on both sides. Such things do not happen overnight.

Electrical contractors in England need not be dismayed. It is likely that such a prize is not beyond their reach if they covet it, but not if they expect to have it handed to them on a plate. They must earn it. In contractor circles there is too much talk of the lion and the lamb, or the spider and the fly, and although it is not stated which alludes to the electricity boards and which to the contractors, few of us are in any doubt about it. In some quarters there seems to be a disinclination to take any step which might "help" the boards. In others it is felt that the boards should take the initiative, that is, come along with an offer or suggestion for the contractors to consider. There is reason to believe that on occasion contractors in one or two electricity areas have been within reach of a friendly and not unprofitable arrangement with regard to cookers, entailing no more than putting one or two cookers on show and receiving a small commission for passing the sale on to the board. Indeed, it is understood that such an arrangement is actually in force in one or two instances, though the results are not yet widely known. Other contractors, however, with misplaced pride, regard it as begging crumbs from the rich man's table, and are not willing to negotiate, much less make overtures to the board.

I may have assessed the situation inaccurately. If so, I hope some disillusioned electrical contractor will tell me so. Until then I believe that beneficial co-operation is possible and practicable. It has been tried by other sections of the electrical trade with the boards, and we do not seem to hear any complaints.

No Refrigerator Season

At this time of year we regard the domestic refrigeration season as drawing to a close, although this year there seems to have been no such season. This, however, is a mistaken policy. There should be no "season" for refrigerator selling, any more than for selling heating appliances. The gas industry has no such illusions. We do not see gas fires and gas refrigerators shuttling in and out of showroom windows, according to the time of year. They remain side by side, come heat wave or snow storm, and so should their electrical rivals. The manufacturers certainly do not stop making refrigerators during the winter, and the sellers should not cease to sell them.

A refrigerator is not a meat safe, in which to store the milk and joint during hot weather. It is no more a food cupboard than is a cooker. It is a very efficient and versatile appliance, offering endless aids to all-the-year-round variety and economy in cooking, and the lucky owner, instead of deploring the cost, wonders how she ever managed without one.

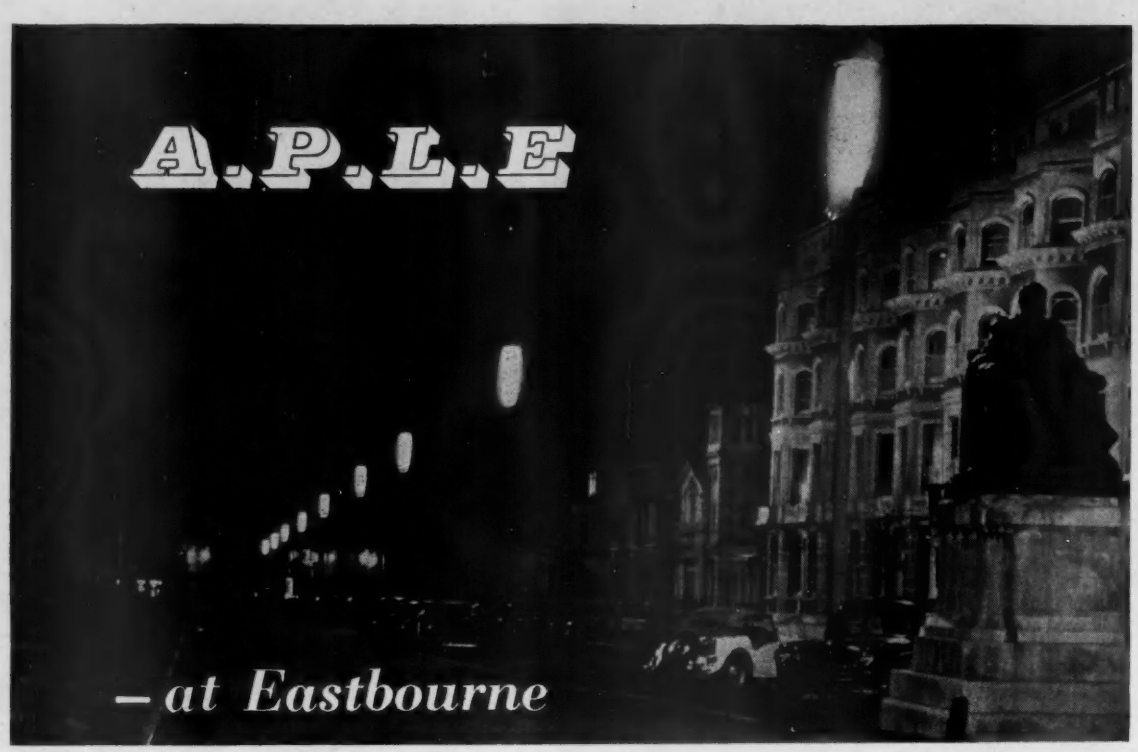
The retailer new to refrigerators will find an industry well organised in all directions, but particularly in his favour. Whether he is responsible to, and appointed by the manufacturer, a wholesaler or an area distributor, he will get a good discount, plus an installation fee, plenty of sale and publicity aids, and a straight deal, almost free from price-cutting and back-door discounts. Most domestic cabinets are bought on hire-purchase, and the dealer will have that all arranged for him. Finally, his obligations for service are not exacting. The modern sealed unit system demands only moderate skill for replacing a unit, but whatever system is used the domestic refrigerator is a reliable and long-suffering piece of apparatus. It does not call for frequent attention, nor at critical moments, as for instance, a television receiver.

Discount Snatching

Is discount-snatching much of a menace now, in this country? At one time there was quite an outcry against clubs and associations formed ostensibly for social purposes but really as a means of cadging illicit discounts for their members. In the United States discount selling, as it is called, is big business. From all accounts the country teems with "Buying Clubs" and "Buying Leagues," all with the same aim. Most of them are open to anyone who cares to pay the few shillings entrance fee. Others are exclusive to the employees of large concerns, and these award the members a part of the filched discounts, retaining some of the spoils to finance dances, outings and similar welfare enterprises. All of them shun that horrid word—discount.

The sinister feature of this movement, and indeed most forms of irregular discount giving, is that only the retailer suffers. The manufacturer or "discount House" gives nothing that is his to give. He only "sacrifices" the discount that should go to the dealer, leaving his own normal profit or discount intact.

The solution, according to United States opinion, is to reduce discounts. That may seem a drastic remedy but it is worth considering. Generous discounts tend to encourage price cutting, whether to buying clubs or in any other way. There is a temptation to share a large discount with the purchaser, if only as a sprat to catch a mackerel, but if wholesalers had to be content with 5% discount and retailers 10% neither could afford to give any of it away. The consequent loss of profit, it is thought, would be recovered by increased legitimate sales when discount snatching ceased. Meanwhile our American colleagues have a serious problem on their hands, and it is by no means certain that we in England are quite free from it.



L. A. DOXEY
The President

IN many respects, this year's conference of the Association of Public Lighting Engineers, which opened at Eastbourne on Tuesday, is not unlike that at Harrogate two years ago. Then, as now, the conference had as its theme the ever-important subject of street lighting and safety. This year four speakers are concerned with it—the President in his address, Mr Robinson, on Tuesday, and Messrs Christie and Harris tomorrow. With Eastbourne as the venue, the Conference, naturally, is being held at the Winter Garden, Devonshire Park, having commenced on the opening day with the Association's A.G.M. followed by the Induction of the new President, Mr L. A. Doxey. The morning's ceremony was then completed by His Worship the Mayor of Eastbourne, Mr Councillor L. W. Pyle, J.P., opening the Conference and Exhibition of street lighting equipment, which is described on following pages.

Introducing the theme of the Conference, the President, L. A. Doxey (Street Lighting Engineer, City of Leeds) contrasted the public feeling aroused by the first few fatal road accidents in the closing years of the last century, with the calm acceptance of the thousands of tragedies now occurring each year. Of the 50,000 people killed and 1,700,000 injured since 1945, many resulted from accidents occurring in the hours of darkness, and highway lighting engineers are led to ponder upon the number which would have been avoided, or at least rendered less severe, by the provision of efficient highway lighting. Although this can never be known, the number of fatal accidents at night, the majority of them on speed restricted, and often only poorly lighted roads, is a sorry reflection on the general standard of street lighting throughout the country. It is not suggested that the solution to the problem lies in street lighting alone, but no greater contribution could be made to road safety at night than by accelerating the Association's policy to provide lighting of the standard demanded today.

The main difficulties to be overcome, however, are financial, and whilst appreciating the steps taken to direct our national finances, in comparison with assistance extended to other services of value to the community, the financial assistance given to highway lighting appears to be stretching parsimony to the extreme. Only some 5% of the total road mileage in this country come within the requirements of the Trunk Roads Act for the purpose of making grants available toward the cost of its lighting. The remainder are the sole financial responsibility of the Local Authority.

These will include roads which, although perhaps not trunk roads, are important busy traffic routes and it will surely be agreed that the lighting of such routes as these, forming part of the national highway system, should no longer be regarded as parochial problems but as national responsibility, financial assistance being given to particularly the smaller Local Authorities to enable them to provide lighting to the standard so urgently required. Moreover, where such Authorities are not in a position to engage a full-time lighting engineer capable of devising a scheme of this standard, they would be well advised to take full advantage of technical assistance given readily by supply authorities or equipment manufacturers. A further consideration to be borne in mind is the type of road surface to be lighted, a factor over which the lighting engineer has little control. Co-operation with the road engineer is therefore essential.

In our heading photograph of Devonshire Place, Eastbourne, the lighting is controlled by Venner type MSSP time switches

W. ROBINSON
B.Sc.(Tech.) A.M.I.E.E., F.I.E.S.

AFTER the President's comments on street lighting and road safety, the subject was pursued by W. Robinson, B.SC., A.M.I.E.E., F.I.E.S. (E.D.A.) in a comprehensive analysis of statistical data on road accidents, extracting therefrom a quantitative assessment of the real value of street lighting as factor in road safety. That such an assessment is necessary is made clear by public and official regard for the importance of street lighting in road accident prevention. Although the importance of good visibility is generally recognised, attempts to draw attention to the major part played by street lighting are usually met with polite regard only one stage removed from indifference.

Not a little of this attitude stems from the lack of conclusive evidence of the effect of lighting conditions on road accidents, and therefore, after defining terms, the author lost no time in considering road accident statistics. An analysis of figures for 1952 shows that night time accidents are usually more severe, pedestrians being most vulnerable to fatality. Moreover, the risk of fatality to each road user at night, irrespective, broadly, of class, is some three times that by day, whilst the risk of serious injury is twice, and of slight injury, 1½ times as great.

In studying the change in pattern of total road casualties according to the class of road user between 1945 and 1952, several features are significant, particularly a disproportionate increase in night time casualties compared with day-time casualties. Moreover, this increase is proportionately greatest for death and serious injuries, showing conclusively that the danger at night is increasing.

As visibility is the major variable between night and day road conditions, it may be assumed that its inadequacy is the main cause of this excessive night-time risk. Other factors, however, influence night-time road accidents, particularly wet conditions, but as skidding accounts for only 16% of accidents on wet roads, it is reasonable to conclude that the major effect of wetness is on visibility conditions. Fatigue and intoxication are shown to have a small effect (only 1% of all accidents in 1952 were attributed to this cause) and it is further argued that the dangers associated with both would have been offset by better visibility. The effect of "Summer Time" as shown by road accidents in October, further supports the inference that poor visibility is the most important factor in increased night casualty rate. Further data show that three-quarters of all accidents occur on speed restricted roads, although accidents on de-restricted roads are far more severe. By far the majority of accidents occur on straight roads, or at T and Y junctions.

The present unsatisfactory position of road safety at night applies despite the presence of street lighting of one form or another on most populated roads, on which 75% of all road casualties occur. However, the conclusion is not that street lighting is a source of danger, but that the danger arises from urban congestion and the mixing of pedestrian and vehicle traffic. That street lighting contributes to safety is made clear by considering the results when it is removed and in the first year of wartime blackout, road fatalities at night were almost doubled. Without street lighting, pedestrian road traffic would be greatly reduced after dark, and hence its existence whether good or bad, makes for greater exposure to danger. Moreover, well-lighted roads attract vehicular traffic from other roads, thus defeating attempts to relate the relighting of individual roads to their increased safety and showing that the true value of good lighting cannot be recognised unless it is universally applied. It is known, however, that poor lighting establishes a false sense of security in vehicle drivers, who generally tend to use sidelights only when travelling in urban areas.

Unfortunately, the attitude often adopted toward road improvements tends to obscure the importance of street lighting. In considering the case for better roads, for which some £500 millions are required as a starting point, road improvements are, fundamentally, required to clear transport bottlenecks and cannot possibly be carried out on a large scale for many years. In any event they cannot eliminate the closing mixing of pedestrian, cyclist and vehicular traffic, which is the crux of the whole problem, whilst the expenditure of less than one-tenth of the sum needed for extensive improvements would be enough to improve existing street lighting to an extent which could bring about a substantial improvement in night time road safety. The modernisation of all existing traffic route lighting would take considerable time even if present financial and administrative obstacles were removed. For the immediate future, therefore, a concentration of effort on improving existing traffic route lighting to Group A standard, improving the effectiveness of pedestrian crossings and immediate improvement in the lighting of junctions and cross roads are suggested as priorities whilst on a longer term basis, a national policy is necessary for traffic route lighting which should also aim at the lighting of trunk roads where appropriate and integration of main roads lighting throughout their entire length.

Day and night views of the Conference town. Left, a view of the Western Lawns to Beachy Head and, right, the Pier and Bandstand at night

Top is Aeroplastics "Carrick" lantern for Group A lighting with the Holophane lantern designed for house side mounting. Below, left, is Franco's new "Exlite III" fitting for traffic direction signs, and right, the Gowshall unit for the same purpose

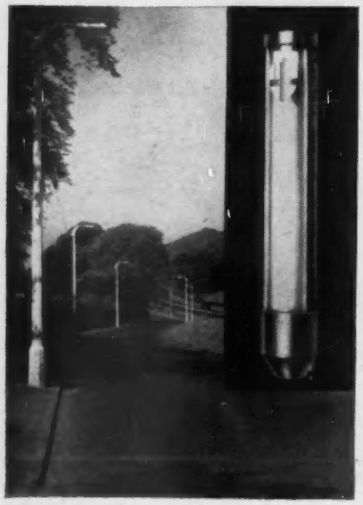
THE EXHIBITION AT EASTBOURNE

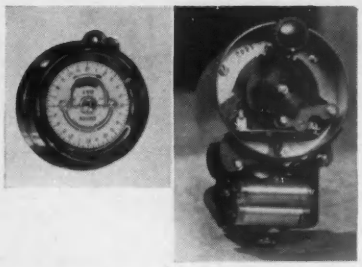
STAGED in the Pavilion, Devonshire Park, and its adjoining grounds, the Exhibition of street lighting equipment, ranging from lamps and lanterns to mobile tower wagons, presents this year a number of new items for the street lighting engineer. Among these are seen two further examples of the modern tendency to design lantern and column in a single unit, two lantern manufacturers introducing columns made to their design for specific fittings. Altogether, some 30 manufacturing organisations are represented at the Exhibition, which is open each day for the duration of the conference.

Setting the theme for the part played by improved electric street lighting in reducing the night-time accident rate, E.D.A. draw attention, in their 24-page brochure "a Matter of Light or Death," to the increased accident rate after dark, stressing the need for better street lighting. Particularly is this necessary in roads which carry mixed pedestrian and vehicular traffic, where lighting in most cases does not conform to standards required for safety.

Playing the leading part in the night-time drama, the lantern is offered in a variety of types and for tungsten, mercury or sodium vapour lamps. Primarily designed for the sodium lamp, in its 140 W size, is the "Carrick" lantern, shown by the Scottish firm, Aeroplastics Ltd. It is designed for Group A road lighting, and may also employ an 85 W sodium lamp. Also on show is a scaled-down version, the "Kyle" lantern, which,

An installation of Metrovick SO50 Lanterns at Bowling, Dumbarton with inset a new Revo wall mounting fluorescent lantern

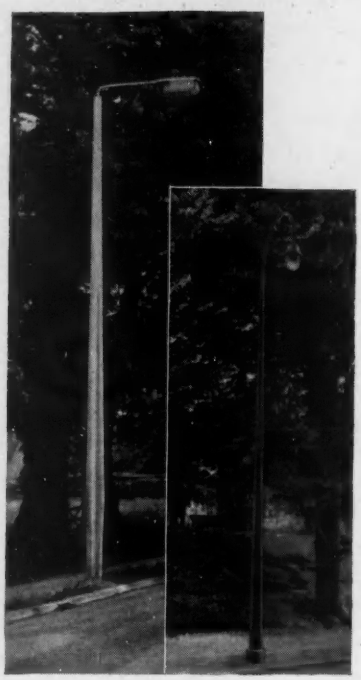




Sangamo Weston's SSC time switch with Horstmann "Zebra" flasher unit, with cover removed

using 60 or 45 W sodium lamps, is suitable for Group B lighting. Where space for control gear is limited, the "Golden Ray mk III" lantern, produced by the Engineering and Lighting Equipment Co., Ltd., is of particular value, providing accommodation for their equipment in the hood of the lantern. Of straightforward design and construction to minimise maintenance work this lantern is suitable for both 45/60 W and 85/140 W sodium lamps.

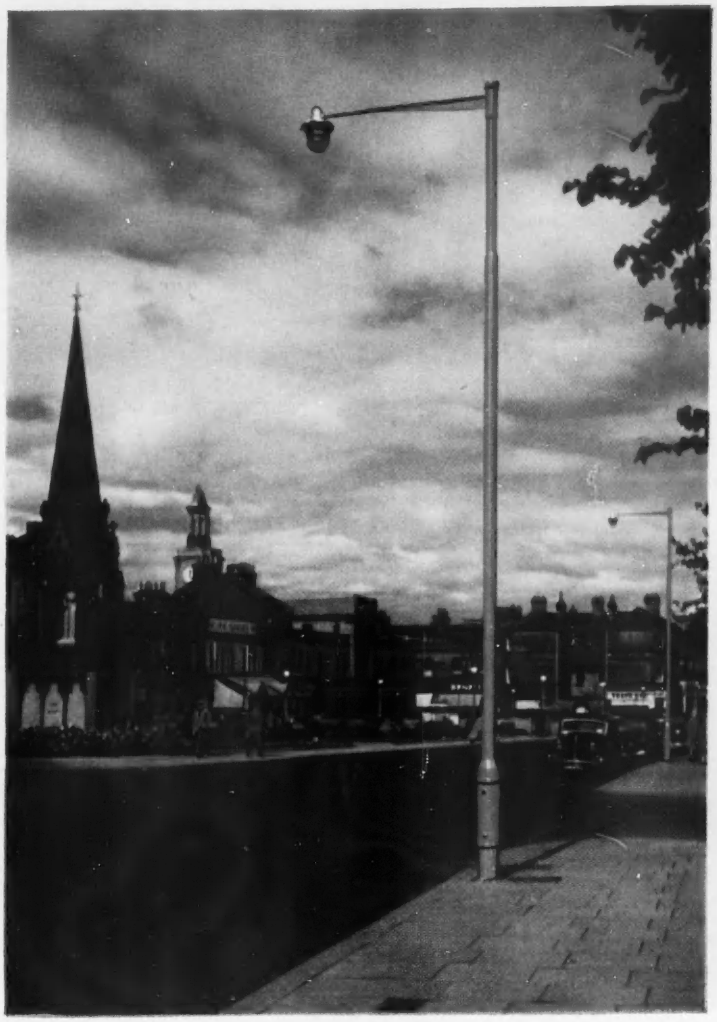
Of lanterns displayed by Falk, Stadelmann and Co., Ltd., two newcomers are to be seen in the "Wellesley" and "Dragonfly" fittings, both for Group B lighting. Suitable for 100/200 W tungsten, or 80/125 W mercury vapour lamps (either MA/V or MBF/V), both lanterns are basically similar, having a hood of die cast aluminium alloy, treated by the "Alocrom" process to ensure high corrosion resistance. In the "Wellesley," however, light control is effected by a glass dome refractor enclosed in a clear outer bowl, whilst the "Dragonfly" employs a single prismatic bowl refractor. Also designed for Group B lighting is a new lantern shown by Holophane Ltd., designed for mounting on the walls of buildings fronting on to narrow streets. Pear shaped in front elevation, the lantern as shallow as possible for use with a 200 W lamp, the body casting being on 2½ in. deep at the bottom. A new type prismatic front glass gives non-axial light distribution.



BTH's newly developed column for use with new range of fittings, and right, an attractive "Adastra" column by Poles, Ltd.

For use in the vicinity of aerodromes, a lantern shown by the Revo Electric Co., Ltd., is fitted with aero screens and uses 140 W sodium lamps. Known as the C131*4, it is fabricated from cast aluminium alloy and incorporates specially-formed prismatic panels to provide medium angle non cut-off distribution, the aero screens limiting the upward emission whilst permitting a staggered 135 ft spacing at 25 ft mounting height. Where secondary roads, approaches or sidings have to be lighted, redesigned "Rodalux" and "Ruralux" reflectors, shown by Benjamin Electric Ltd., are eminently suitable providing simplicity with economy. A new feature is an interchangeable grip flange, which allows the reflector to be rapidly detached, and simplifies wiring.

Among columns shown in the outdoor display, the British Thomson-Houston Co., Ltd., feature their new 25 ft column



TUBULAR STEEL LIGHTING COLUMNS

TYPE Gb. 583, 25 ft. M.H.

For Group 'A' roads, suitable for electric lighting

STEWARTS AND LLOYDS LIMITED

GLASGOW • BIRMINGHAM • LONDON

The largest manufacturers of steel tubes in Europe

S&L

Millions will read about it

FROM THE FIRST TOUCH of colder weather millions of people will be reading about the cosy comfort offered by Memvair electric convectors. Selling advertisements will appear through the autumn and winter in 'Radio Times' and in selected national newspapers and magazines with a total readership of 28 millions. Make certain you profit from this advertising by having ample stocks to meet the demand.

Three ratings now: Memvair is now made in 1, 1½ and 2 kW ratings, each with or without thermostat.

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THE MEMVAIR ELECTRIC CONVECTOR HEATER

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MIDLAND ELECTRIC MANUFACTURING CO. LTD.
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which has been designed for use with a new range of lanterns. Essentially plain in appearance, the column may be fitted with single or double arm brackets and may be supplied with sockets for attaching traffic signs. It is shown with their new "Amber" refractor lantern for Group A roads, and designed for use with 140 W sodium lamps. Another new example of columns designed for lanterns is shown by the General Electric Co., Ltd., who display their "Altus" and "Brevis" designs, for mounting heights of 25 ft and 15 ft respectively. Combined pre-stressed high steel and unstressed mild steel reinforcement is employed. Brackets for side entry, top entry or post top mounting are available for both, whilst the "Altus" column can be supplied with double-arm brackets.

Of columns in steel, Poles Ltd. show their range of "Adastra" designs, now augmented by three new columns. Foremost of these is their universal column, which, like others in this range, is of tapered sectional steel galvanised construction. Giving a 25 ft mounting, it is only 7¼ in. in diameter at its base, being, therefore, most suitable for lanterns housing their own auxiliary gear. Stewarts and Lloyds Ltd. display a variety of columns of approved design for both Groups of lighting, and fitted with lanterns for tungsten, sodium or tubular fluorescent lamps. Their subsidiary, Tubewrights Ltd. feature a 40 ft high tubular steel floodlighting tower, which, capable of carrying up to six lanterns, is eminently suitable for sports-ground lighting.

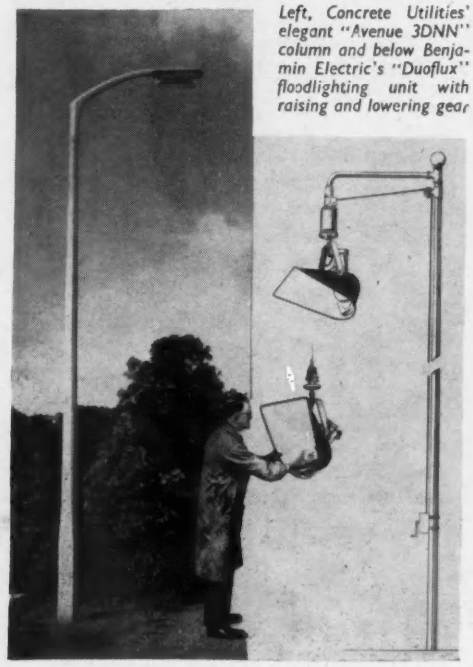
Featured by Concrete Utilities Ltd. is their new "Avenue 3DNN" column, so far the slimmest of their designs. It has a newly designed Arc III bracket which is available in standard outreaches. Of approved design, the column is manufactured in a spinning and vibration process to give high resistance to impact.

Falk's new "Dragonfly" lantern is seen on the left, and right, the new G.E.C. "Three Eighty" cut-off lantern for fluorescent lighting

The recently developed high-pressure mercury vapour discharge lamp of improved colour rendering now offers considerable possibilities for side road lighting and this can be seen at the Cavendish Hotel, where the Metropolitan-Vickers Electrical Co., Ltd., have examples of their equipment on show. Here it is displayed in their "SS Fifty-One" lantern, the combination being eminently suitable for Group B roads. Another aspect of public lighting—that of floodlighting makes its appearance on the Thorn Electrical Industries Ltd. stand, where fluorescent lighting forms the centrepiece. The appearance of fluorescent floodlighting is particularly enhanced by the use of dimmer circuits, examples of which are demonstrated. Philips Electrical Ltd. are also exhibiting, on stand 23.

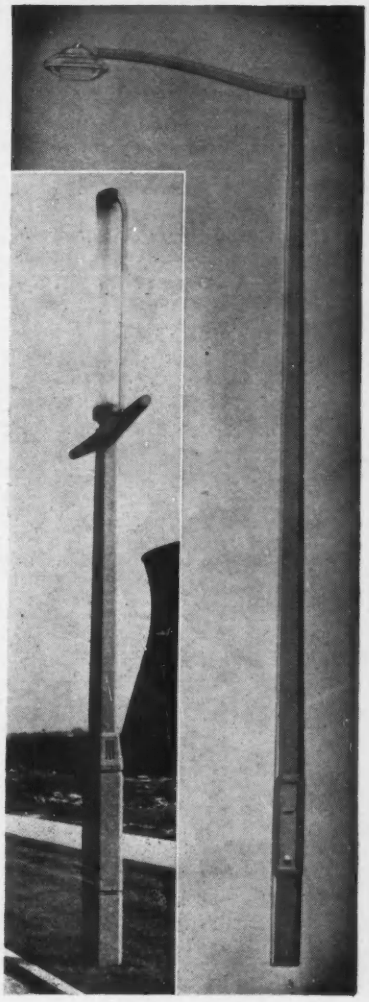
In the field of street lighting control, the Automatic Telephone and Electric Co., Ltd., show their well-known "Rythmatic" ripple control system for centralised remote switching over large areas. For local control, the electrically wound time switch offers advantages over other types and in this sphere the British Foreign and Colonial Automatic Light Controlling Co., Ltd., offer their type FW/10, rated at 10 A, 200/250 V a.c. for street lighting control. Sangamo Weston Ltd. feature their type SS synchronous time switches of which many types are available for controlling street lighting, whilst on the Venner Ltd. stand a versatile unit is the type MSSP solar dial time switch shown operating under water. To complete the range of control gear comes the flasher unit developed for "zebra" street crossing beacons, being shown by the Horstmann Gear Co., Ltd.

Of other forms of street furniture, traffic direction signs are a particularly important part, and their legibility at night is essential if confusion and possible danger is to be avoided. Fittings for their illumination are shown by Franco Traffic Signs Ltd., who have, in their new "Exlite type III" unit, an attractively styled twin lamp robust and weatherproof fitting eminently suitable for this purpose. Another equally suitable design is offered by Gowshall Ltd. (see page 402). In the outdoor display a tower ladder is featured by R. A. Lister and Co., Ltd., with a unit lifting up to 24 ft 6 in.



Left, Concrete Utilities' elegant "Avenue 3DNN" column and below Benjamin Electric's "Duoflux" floodlighting unit with raising and lowering gear

Here are, left, Thorn's stylish fluorescent fitting employed at the Rye House power station approach with the G.E.C.'s new "Altus" column shown with a side entry "Dioptron" lantern



Design for Street Lighting

ATTENTION last week was again focussed on the sometimes thorny subject of street lighting column design by the Council of Industrial Design who sent to more than 2,000 Local Authorities a list of designs approved by them. Included with the list was a copy of the September issue of the C.o.I.D. journal "Design," in which a 24-page article dealt fully with design of street furniture in general. The Council, through its Street Furniture Committee, is responsible for approving designs of street lighting columns and the Ministry of Transport requires that only those columns approved by the Council may be used for trunk road lighting where a grant is made from Central Funds.

Since January, 1952, the Council has been concerned with approving column design, having taken over, at their request a task formerly undertaken solely by the Royal Fine Art Commissions. These bodies are no longer required to maintain a list of passable designs and moreover, column manufacturers are progressively withdrawing from production columns originally passed by the Commissions and not now acceptable. The Council's work, with co-operation from manufacturers, has led to a substantial improvement in the aesthetic standard of columns for Group A and B road lighting. In a list of over 300 approved designs, a wide range of slim and unobstrusive columns is now available. Design of a good mass produced street lighting column is not a simple problem as its height, to ensure an efficient distribution of light during darkness, may be out of scale with its surroundings when seen in daylight. As it would be impracticable to design afresh for each locality, the best solution would seem to be an elegant modest column in which undue emphasis or ornament is eliminated.

In its special article in "Design," profusely illustrated to indicate modern examples of good column design, the Council comments generally on difficulties involved in siting and design of street furniture, applauding the degree of co-operation which exists between Local and Nationalised Authorities. As an example, the Corporation of a new town was permitted to influence the design and siting of an electrical substation. In referring to collaboration between manufacturers, the Council applauds the co-operation now existing between those concerned with lanterns and those with columns. The third member of the team—the control gear manufacturers—are thought to be lagging behind, and the article comments that the scaling down in size of control gear, as practised in the U.S.A. has hardly been tackled. Only the ingenuity of the column manufacturer has resulted in the slim appearance of new designs and with more careful attention paid to design and size of control gear, further improvement may be obtained.

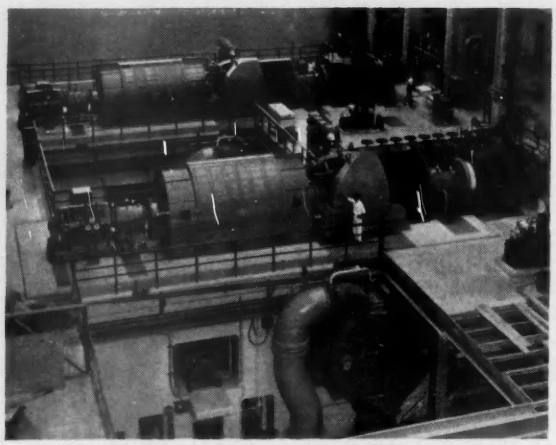
Stimulating Demand in Singapore

WITH the commissioning of Pasir Panjang power station last year, the City of Singapore abandoned its electricity rationing, and once again permitted domestic appliances to be connected (large numbers had been installed but left unconnected in the previous months). The immediate demand for hired appliances was more than the Electricity Department's existing installation staff could cope with, and a scheme was devised whereby consumers are permitted to appoint their own electrical contractor and obtain reimbursement, at fixed rates, after the wiring installation has been inspected and approved.

In his report for the year ended 31st December last, just received, Mr C. C. Payne, the city electrical engineer, states that by the end of that year this new system had been functioning for five weeks during which time 1,900 hired appliances had been issued to contractors for installation. Appliances on hire at the end of the year consisted of 4,298 cookers, 2,133 water heaters, 18,285 fans and 453 motors, and in view of the present campaign to increase electricity consumption, those totals are likely to rapidly rise. The number of consumers increased by 6,417 to a total of 58,371 during the year. Units generated over the twelve months totalled 278 millions—an increase of 29%—of which 212·5 millions were generated from Pasir Panjang power station (details of which were given in our 8th January, 1953, issue). It is stated that oil fuel consumption at Pasir Panjang was 0·705 lb/unit generated, compared with 1·5 lb/unit at the St. James' power station. The early inauguration of the Pasir Panjang station greatly improved the financial position, but a net deficit of $1,154,240 was sustained from the year's operations. Mr Payne emphasises that still further substantial increased sales will have to eventuate if the Department is to maintain even its present position.

The distribution side of the undertaking had a busy year also, over 63 miles of 22 kV cable, and 38 miles of l.t. line being installed along with 41 substations. Rapid industrial load growth on the fringes of the city and in the rural areas made it necessary to depart somewhat from the system of distribution previously adopted. A number of extensible type 22 kV ring main isobreakers have been ordered which, in conjunction with 22 kV/440 V transformers, will provide a most economical means of supplying energy to industrial consumers in outlying areas.

At the Pasir Panjang power station work proceeded satisfactorily. Two boilers (Babcock and Wilcox) and two Metropolitan-Vickers generators operated for nine months of the year covered by the report, and No. 3 boiler was commissioned early this year. It is anticipated that No. 3 machine and No. 5 boiler will be in commission later this year, bringing the installed capacity of the station up to 75 MW. Meanwhile, the opportunity has been taken to thoroughly overhaul the old St. James' power station.



The first two sets installed at Pasir Panjang power station

Marking Meter Discs

A PLEA FOR THE STANDARDISATION OF INDICATIONS

By G. E. MOORE, M.I.E.E.

PRACTICALLY all meters are of the rotating kind, declaring the value of the measured quantity by advances of a register. Though a meter's accuracy must be ensured in terms of registered quantity over a long period, a great deal of attention is directed by the meter faculty to the rotor disc—for reference to the prime mover enables a tester to carry out the short-period tests in calibration work, and the same vital part is a ready source of load-information when the meter is in service.

For this work meter discs have always carried a mark by way of index. At one time, when basic speeds were high, the mark was often a crude dab of paint. Makers and users have shown surprising idiosyncrasies. Marks have taken different shapes and have not always been solid or black; they have been given sharp points or scratch-marks as an aid to meticulousness; they have been extended over the edges of the discs and even along the bottom sides (a useful facility in high-mounted meters); and one expedient was a paint-iron filings mixture acting as combined index and anti-creep device.

The single mark served the purpose of measurements by complete disc revolutions. But in comparison tests with another rotating meter the "splitting" of a revolution during a run, or at the end of a run, gave useful information. Disc-stiffening serrations or anti-creep holes gave aid of a kind if a gauge could not be applied.

Thus there came into use quadrant marks, three of these smaller than the main index and sometimes coloured differently. A further development in the case of rotating substandards was to mark-off the disc in 1/10ths a convenience that was useful even in substandards which registered in disc-revolutions, for the disc itself was a more accurate reference than the first dial.

The Closed Scale

It early occurred to the writer that the rational step was to give all meter-discs a closed scale; at this time he had found stroboscopic meter testing to be feasible at good loads and came to the conclusion that a double-purpose scale was practicable. In 1922 he filed at the Patent Office a specification which required the disc to be manufactured with 100 marks, the tenth marks being numbered 0—9 and the zero mark carrying the disc spot; the scale-marks were to be either painted, or physically indented or embossed as part of the disc-stiffening process.

Neither disc-scaling nor stroboscopic testing aroused any interest in the meter makers who were approached. At that time the writer did not appreciate that manufacturers' conservatism would in part be due to a reluctance to modify a mass-produced product for a market that might not welcome or understand it. The patent therefore had to lapse.

During ensuing years basic meter speeds were reduced, and the single marks on discs were more neatly imprinted. Certain manufacturers adopted stroboscopic testing to aid their own calibration work and indented or painted suitable patterns on their discs; in at least one case the peripheral marks were 100 in number and for special meters users adapted them for scaling in 1/10ths and 1/20ths. At least one make of substandard had a disc with 0·1 and 0·05 marks.

The writer returned to the subject of disc-marking in his 1944 I.E.E. Paper "Planning the Future Electricity Meter," proposing that the British Standard for Electricity Meters should make certain requirements. These were: Provision of 100 radial lines near the periphery; tenth lines to be numbered; zero line to bear the apex of a black triangular spot; and zero disc-setting at no-load to be unaffected by operation of anti-creep device.

The draftsmen of British Standards for Meters have never evinced any interest in the subject, though the disc plays so big a part in meter engineering work in testing stations and on site. They may argue that a British Standard is not intended to point the way but merely to adopt an agreed if limited basis of standardisation based on existing products. One can therefore only hope that enterprising makers and informed users will be persuaded of the advantages of scaled meter-discs.

In this development a number of aspects will be of importance. For any part-revolution to have an accurate value, the disc must be uniformly sensitive throughout its revolution; this will require special care in its physical processing and a strict limitation to the power of the anti-creep device.

These conditions met, the mark-frequency for stroboscopic testing could be raised by employment of patterns having more than 100 points or marks (the writer has used up to 360). The higher mark-frequency would improve both the accuracy and the loads-coverage of stroboscopic observation. For discs to be studied in visual comfort the meter designer should make it possible for ample light to reach the disc and for a sector of at least 40° to be exposed. Neither disc material nor marks should be bright and there should be good contrast.

The remarks in this article may be regarded as applicable to a disc in a multi-disc meter as well as to single-disc 2-wire, 3-wire and 4-wire rotating meters. And finally it may be pointed out that some users have employed rubber stamps for imprinting stroboscopic patterns on their plain meter discs. This expedient may be resorted to for the double-purpose or the single purposes described; it can be locally devised and carried out, but one can, therefore, only hope that eventually most manufacturers and users will be persuaded of the advantages of scaled discs for all meters.

Electrical Teaching Abroad

DETAILS of advanced courses in electrical engineering in France and Sweden are given in a recent publication issued by the Ministry of Education on behalf of UNESCO ("Inventories of apparatus and materials for teaching science, Vol. III, Part 4, Technical Colleges—Electrical Engineering," price 15s. 6d.). The French establishment described is the Ecole Supérieure d'Electricité, which organises a full-time non-residential course leading to a diploma. The full course lasts two years.

At the Kungliga Teknisa Högskolan in Sweden, the course generally last four years, during which the student is expected to spend at least six months in industry.

Reactors and Metallurgy

IN the design of atomic power reactors, metallurgical considerations are of major importance. This was brought out by a lecture given by Mr H. M. Finniston of the Atomic Energy Research Establishment, to the British Association Meeting at Oxford. Apart from the main fissionable materials, two other metals, zirconium and beryllium are particularly suited on neucleonic grounds as structural materials. Taking both fuel metals and structural metals together, attention is being paid to methods of extraction, purification and fabrication, involving the use of techniques such as vacuum melting, arc melting, sheath rolling and powder metallurgy. At the same time the development of chemico-metallurgical processing of fuels which have seen service in reactors is of major economic importance, as it is essential to remove fission products at minimum cost.

Higher temperature operation is vital for power production, and three fuel types are being investigated. These are (*a*) metallic fuels in a matrix of high melting point (uranium in thorium—1,700° C,—or zirconium—1,860° C); (*b*) metallic fuels in ceramic on cermet (uranium carbide—2,250° C, or thorium uranium oxide mixtures—2,200° C), and (*c*) in slurries consisting of a mixture of a high melting solid in a liquid metal of high boiling point such as urnaium in lead. The problems of these fuels are fabricating, reprocessing and containing.

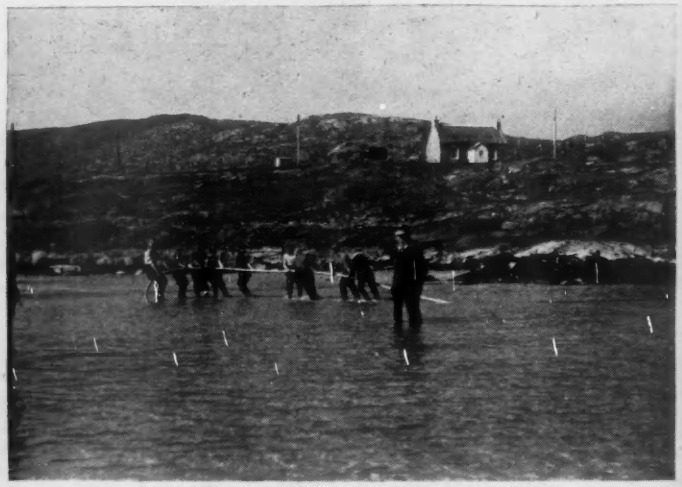
The coolant dictates the container in most cases. For gas-cooled piles an oxidant resistant, non-inflammable magnesium alloy has been developed; for high temperature high pressure water (300° C, 2,000 lb/sq in.) a zirconium based alloy is required, and for sodium-cooled reactors other high strength zirconium alloys are being sought.

Mr Engelstaff, also of Harwell, in his talk dealt with the effect on performance of a reactor, of a particular fission product, Samarium 149, and showed how measurements could be made to investigate the "poisoning" effect of this product. A third lecture by Dr Hume-Rothery, was particularly interesting in giving a theory showing how an actual metal departs from the perfect equivalent in its crystalline properties. Generally speaking, the scientific work of 1920-39 placed emphasis on the ideal crystal, and much progress was made in developing the theory of ideal metallic structures. The importance of imperfections, however, was gradually recognised and since the war has been actively developed. At the moment there was rather a separation.

Supply for the Outer Hebrides

AS part of the general policy towards electrification of remote areas, the North of Scotland Hydro-Electric Board have turned their attention to islands in the Outer Hebrides. On the island of South Uist a new diesel power station now under construction, will be of sufficient capacity to supply not only the local needs but those of Eriskay, an island just over a mile away. The Board, acting with Merz and McLellan Ltd. as consultants, decided to connect the islands with a 22 kV submarine cable and W. T. Henley's Telegraph Works Co., Ltd., were awarded a contract to supply and lay the screened 3-core p.l.s.w.a. cable. Due to the rocky nature of the sea-bed, which precluded a straight cable route, 2,900 yards were required.

S.S. "Invercloy," a local vessel, was found to be particularly suited to cable-laying, since being flat-bottomed it could easily be beached for landing the shore ends of the cable. Paying-out and braking gear were added and the hold loaded with the cable at Princes Dock, Glasgow. Soundings taken at low tide, confirmed the route and starting from Eriskay, cable-laying proceeded at a speed of approximately 2 knots, and was completed in an hour, the ship arriving at South Uist at high water. The ship was beached, and at low water the cable bight was taken ashore and laid up to the terminal pole.



Two scenes during the laying of the Outer Hebrides 22 kV submarine cable. Above: Men are pulling the bight ashore during the landing of the shore end at South Uist. Right: Coiling the cable into the hold of the Invercloy *at the Princes Dock, Glasgow*

Invisible Barriers at Antwerp Zoo

RESTRAINING ZOOLOGICAL SPECIMENS BY LIGHT AND HEAT

An interesting use of special lighting has been developed in the New Bird Pavilion at the Antwerp Zoo. Here in one section birds are kept within brightly lighted compartments without any intervening barrier between them and the public. The birds are in fact at complete liberty yet show no inclination to leave their cages.

The reason for this apparently anomalous phenomenon lies in the habits of diurnal birds, which at night have very limited vision, and consequently do not venture into darkness unless compelled to by physiological or biological needs.

If therefore birds were to be displayed on the same principle as that used for displaying fish in aquaria, with brightly lighted enclosures but with the audience in semi-darkness, it was logical to suppose that they would remain within the lighted area and avoid venturing into the outer darkness.

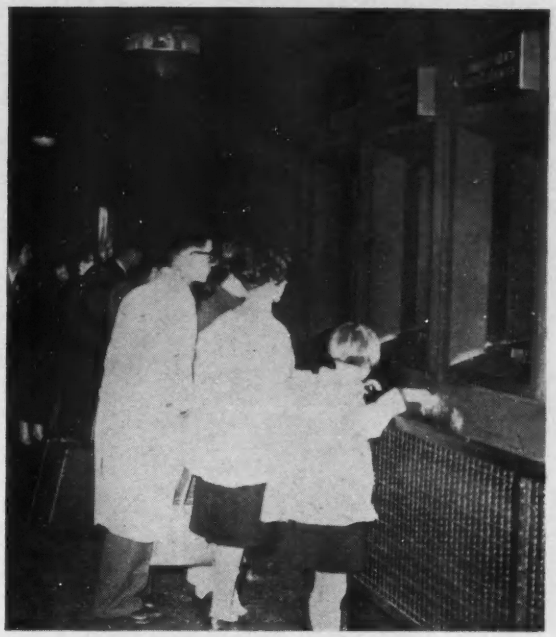
In the Antwerp installation, the lighted area consists of a line of twelve large compartments each with dimensions of 4½ ft deep by 4½ ft long by 6 ft high. These are each illuminated with a bright lighting approaching that of sunlight. The compartments are open to the dark zone, which is simply a darkened corridor along which visitors can pass. A protective barrier holds visitors far enough away from the cages to prevent the birds being seized by outstretched hands.

In the evening, an artificial twilight is introduced by gradually dimming the lighting and this announces the end of the day to the birds and they perch for the night. In the morning the reverse takes place and the light is gradually intensified giving the birds the impression that another day has begun.

This method of presentation has proved most attractive to visitors and was first developed at the Zoo d'Anvers and is now internationally known as the "Antwerp Cage-System." It has also been adopted by other Zoos.

The same technique, though on a somewhat different basis, is being tried out for the exhibition of reptiles, particularly pythons. Here the technique is to place the reptiles in a zone of maximum comfort, and provide an invisible barrier of discomfort. The experimental compartment, which is open at the front, is heated to 26°C, a good tropical heat, and the reptiles are separated from the public by a refrigerated zone, which they will not normally cross. It has, however, been found that snakes are attracted by sunlight and, in the event of a patch of sunlight being available on the other side of the cold barrier, they are liable to cross it in order to take a sun bath. At the moment therefore the system is in an experimental stage.

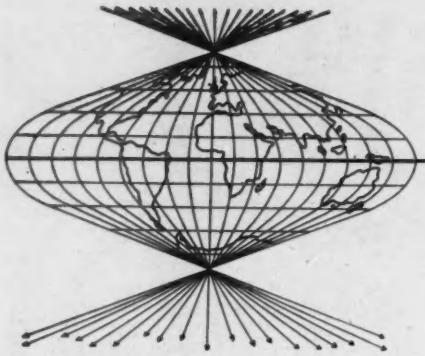
At the London Zoo, in Regent's Park, infra-red lamps are being used to provide conditions under which tropical fauna and flora will thrive. Tropical birds and land crabs are among the exhibits now being irradiated with heat from Osram 250 watt lamp infra-red heaters, and so far the experiments are showing a fair degree of success. The units used are similar to those being utilised by farmers to foster growth in pigs and poultry.



The spectators in Antwerp Zoo Bird Pavilion are attracted by this system of cageless displays

The "window" of a "light cage"

Not even the tasty morsels proffered by the keeper will tempt the birds outside their "cages"



OVERSEAS NEWS

A SUMMARY OF IMPORTANT EVENTS

CANADA

Newfoundland Scheme

Work has started on a substantial new hydro-electric power development on Newfoundland's Bonavista Peninsula. Being undertaken by Union Electric Light and Power Co., the programme will cost $1·1 millions and calls for ultimate development of 4,000 h.p. Trinity Bay, midway along the peninsula, will be used as a hydro power site. Some time ago the Union Electric Light and Power Co. took over the power system of Clarenville, operating it in conjunction with its own system. The new development will mean an integrated system for the whole peninsula, from Clarenville to Cape Bonavista.

St. Lawrence Doubts

The possibility that Canada might waive the normal duties on equipment for the Canadian Seaway contracts, has been denied in Ottawa. Apparently there has been widespread fears that duty-free equipment would automatically hand this construction contract to American firms. One reason for the fear is that special arrangements are being discussed for the very special case of the coffer dams to be built by the Hydro-Electric Power Commission of Ontario and the New York State Power Authority. This has been wrongly interpreted as establishing policy for other Seaway and Power work. The point about the coffer dams is that the Commission and the Authority divided the work so that each would build one dam—Ontario at Barnhalt and New York at Long Sault—which must be continuous across the boundary. In this one case, where the dam has to be built continuously across the frontier, it seemed necessary and desirable to enable one contractor to tackle the project as one job without bothering about customs and immigration formalities. Conversations were started with the U.S. Government accordingly. Neither the main power works nor any of the Seaway scheme presents the same problem as the coffer dams.

Refrigeration Market

It is estimated that 2,415,000 households out of a total of 3,614,000 in all Canada now have mechanical refrigerators, according to a recent survey of the Dominion Bureau of Statistics. But the market is far from saturated, and with new housing progressing at the rate of over 100,000 units annually there are obviously good opportunities for business. Canadian refrigerator production amounted to over 274,000 last year, the twenty manufacturers being mainly either subsidiaries of U.S. firms, or companies making under U.S. licence. According to a market report from the Board of Trade, the U.S.A. dominates as a source of supply for imported refrigerators—out of a total of 184,749 imported last year, 182,482 were from the U.S.A. and 1,506 from the U.K. Latterly the trade from the U.K. has been confined to small models of less than 4 cu ft capacity. The main demand is for large size refrigerators of 7 cu ft and upwards, and the average size now appears to be approximately 9 cu ft with a tendency to rise still further. It is stressed that the electrical equipment must satisfy the Electrical Code of the Canadian Standards Association. The supply is mainly 110 V, 60 cycles.

Rural Development

In Saskatchewan there is rapid development in the electric power field, to which we have frequently made reference. The annual report of the Saskatchewan Power Corporation covering operations during the year ended 31 Dec. last, shows that over 398 million units were sold (an increase of 19·7%) and consumers number 100,100 (an increase of 13,525). In its power plant expansion programme, a 20 MW generator and 200 klb/hr boiler were installed at Estevan. Plans have been made for the construction of a new power station at Swift Current, and an order has been placed with Brush Aboe (Canada) for two 1,275 kW National dual-fuel engine generating units. Construction work on farm electrification was hampered early in the season by extremely wet weather. But favourable weather later enabled all previous records to be broken and about 6,000 farms were connected. In conjunction with this programme, distribution systems were built for 50 villages and hamlets. Where villages are situated beyond the economic reach of transmission lines, the Power Corporation has followed the policy of building distribution lines for these villages, on a rental basis, for local operation. During 1953 such systems were built for four villages and suitable generating units were rented to three of them.

PORTUGAL

Underground for Lisbon

It has been decided to go ahead with the construction of an underground railway for Lisbon. Work is to begin this year and it is planned that the railway shall be in operation in 1957. With the approval of Portugal's Economic Council, a concessionary company is to issue an internal debenture loan amounting to 150 million escudos to meet the cost of the first phase of the work.

S.W. ASIA

Power Cable Manufacture

Shortly to enter the field of manufacturing paper insulated power cables is the Indian Cable Co., Ltd. At the moment, such cables are imported in considerable quantities. The company has already spent about half of the Rs. 176 lakhs envisaged on a capital expansion programme. Under this a new rod rolling mill has been erected and is in operation, and the production of plastic insulated cables has commenced. It is planned to manufacture some other new products.

More Nationalisation

It was recently stated in the Travancore-Cochin Legislative Assembly that the State Government intended to nationalise the distribution of electricity in the State, and to end the existing system of distribution through licensees. A Bill to put this into effect is shortly to be introduced.

Lampholder Industry

India's electric brass lampholder industry is to continue to receive protection. The Government has agreed to a recommendation of the Tariff Commission that the protection be continued for a further two years to the end of 1956. Announcing this the Ministry of Commerce and Industry has said that the Government could not, however, agree to the Commission's recommendation of a reduction in the rates of duties. Apart from revenue considerations the Government felt that, with a level of duty higher than that judged necessary by the Commission, it should be easier for the industry to face competition from imports as and when the existing quota restrictions were relaxed due to improvement in the coun-

try's foreign exchange position. The Ministry added that the Government also proposed to take special measures to help this small-scale industry in getting better organised.

Tramways Being Acquired?

It is reported that an offer has been made to purchase the British-owned Madras Electric Tramways, whose undertaking ceased to operate from April 1953 because it was losing money, and the Madras Government had refused to make a loan of £22,500. The offer has been made by a relative of a prominent South Indian industrialist, who has made an initial deposit of Rs. 250,000.

AUSTRALIA

Development Expenditure

Major extensions of power supply are planned by the Capricornia Regional Electricity Board this financial year. The Board manager, Mr H. E. S. de Kretser, stated recently that the extensions were included in the budgeted expenditure of £1,250,043 for developmental works. A total expenditure of £2,147,548 has been budgeted for by the Board for this financial year. Extensions of supply now being completed were from Gladstone to Monto, a distance of about 75 miles; from Monto to Thangool, 55 miles; and Wowan to Baralaba, 30 miles. The Board contemplated extensions from Yeppoon to Yaamba, about 25 miles.

Another Factory

A site at Darra for what is claimed will be the largest electrical equipment factory in Queensland, has been approved by the Brisbane City Council Registration Board. The site is for the Australian General Electric Pty. Ltd. The state manager of the company, Mr N. R. Johnston, has said that the company would eventually employ between 500 and 750 people. The products to be manufactured include transformers and switchgear. The factory site covers 10 acres in the green belt between Archerfield and Boundary Rds, Darra.

Wind Power?

South Australia may be the first Australian State to use wind for large-scale generation of electricity. Wind measuring instruments are to be installed along the coastline as a first stage of research to ascertain whether such a project would be commercially sound. These recording stations are to be set up between Fowlers Bay and Cape Northumberland; also on Kangaroo Island and at inland sites on Spencer Gulf, St. Vincent's Gulf, the Kapunda area, Lameroo and Naracorte. Mr F. L. Mullett, a member of the Planning Department of the Electricity Trust of South Australia which is conducting the research, has said that if the results of the wind survey are as good as theory predicts, the coastline and the hills between Adelaide and Victor Harbor would have sufficient sites for 20 to 40 aerostations. This battery of stations would deliver 250 million kWh a year—about one-third of the amount of power generated at present. If the wind blows too strongly during off-peak hours the aerogenerators will require to be automatically yawed out of the wind.

NEW ZEALAND

Filling them in

The Auckland City Council and the Auckland Electric Power Board, N.Z., are in dispute concerning the reinstatement of cable trenches. The City Council recently refused to reinstate trenches dug in city streets by the Board's cable layers. The Board has offered to pay for this service, but the Council has again stated that it sees no reason to depart from the present procedure, which requires authorities digging the trenches to reinstate them. Mr N. M. Speer, general manager of the Board, has said that system caused the Board endless trouble, and was an unsatisfactory arrangement as far as the Board were concerned. In his view the council staff had the expert knowledge for reinstatement work. The Board is making further representations to the Council.

Extension Work

On the recommendation of its engineer, Mr Hide, the Otago Electric Power Board, New Zealand, has agreed to institute ripple control into the Board's southern area, at an ultimate cost of £13,280. The cost of the main plant and 200 relays for the first year would be £7,620, and for the next three years the costs of relays would be £2,666 each year. Agreement has been reached between permanent residents and farmers at Taieri Mouth and the Board for the supply of electric power. The cost of such distribution work will be £12,000, the largest item in this expense being taken up with the reconstruction of a feeder branch from Waihola at a cost of £3,500. At the meeting of the Board it was announced that the Treasury Dept. has granted sanction to the Board to raise a loan of £25,000 for work on extensions, although the sum of £50,000 had been sought.

Waipori No. 3 operating

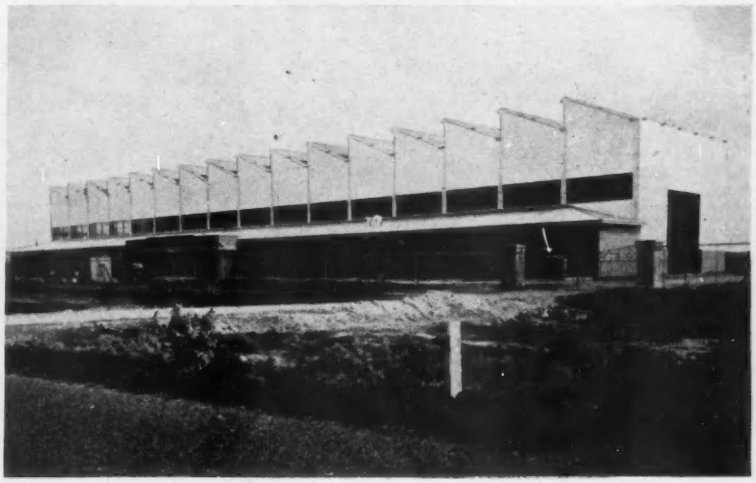
The generator at the Dunedin City Corporation's No. 3 Waipori power station has been put into commission. This is a Boving vertical Francis turbine, running at 375 r.p.m., coupled to a B.T.H. 6,400 kW generator. A similar turbine and a 7,200 kW alternator are on order for the Council's No. 4 station three miles further down on the Waipori River. Both No. 3 and No. 4 stations will be automatic, control being effected from the No. 2 station where seven machines have been in operation for some years.

JAPAN

Licence Arrangement

We understand that the Swiss firm of Oerlikon has just concluded an agreement with the Kawasaki Dockyard Co., Ltd., of Kobe, Japan, under which the latter concern will produce generators and transformers for the Asian market under licence from Oerlikon. Initially the latter company will provide technical assistance, it is stated.

An excellent example of the present trend of British concerns to establish manufacturing facilities in Commonwealth countries, are the Whyalla works, South Australia, of C. A. Parsons of Australia Ltd., shown below. These are being opened on 27 Sept. by The Hon. Thomas Playford, Premier of South Australia. The first Parsons turbo-generator installed in Australia (of 120 kW) was supplied in 1896 to the Victorian Railway Commissioners. Since then that firm has supplied or has orders for over 2 million kW of generating plant for Australia. The increasing demand led C. A. Parsons and Co., Ltd., to establish the works at Whyalla where condensing and feed heating plant will be manufactured for operation with steam turbo-generators made at the Heaton Works. On the 50-acre site, the first section of the factory comprises a single bay 400 ft by 60 ft, with an annexe housing the administration offices, drawing office, etc. There is a 30-ton overhead travelling crane and all necessary machine tools to undertake the work initially to be carried out there. Full provision is made for later expansion



Personalities

IN THE INDUSTRY

Mr Robert C. Cox has joined the board of Kenwood Manufacturing Co., Ltd. Mr Cox is assistant managing director of Fisher and Ludlow Ltd., and a director of Bendix Home Appliances Ltd.

Mr G. H. M. Houston, B.SC., A.M.I.E.E., has joined Brookhirst Switchgear Ltd. as manager of their Power Applications Branch. This extension of the Brookhirst organisation has been established progressively to develop the application of motor control gear for power station auxiliaries and kindred applications. Mr Houston and his engineering staff operate from Universal Hse, Buckingham Palace Rd, S.W.1. After some years service with the British Thomson-Houston Co., Ltd., Mr Houston joined the London Power Co. in 1928 and, except for an interval during the last war when he was engaged with the Air Ministry, has since been engaged on power station construction. Before joining the Brookhirst organisation he was electrical engineer responsible for design of electrical equipment in the generating stations of the B.E.A. London Division.

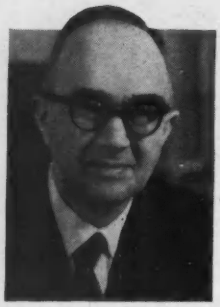
I.T.D. Ltd., the industrial truck concern, has appointed **Mr J. R. S. Halford** as export sales manager in succession to **Mr R. J. L. Fish** who has left the company. Since the war Mr Halford has held positions on the sales or export sides of a number of companies associated with general mechanical products.

Mr Eric S. Chisholm has joined the staff of Heatrae Ltd. in the capacity of London sales manager. Mr Chisholm has served in the Electrical Industry for about 20 years, firstly with the G.E.C. Experimental Test Room at Wembley, then with the Northmet Power Co., and later as district commercial officer, Eastern Electricity Board, Chiltern Sub-Area, at Luton, from which position he resigned to join the Simplex Electric Co. as sales manager of their Electric Water Heating Department. He will be assisted in his work by **Mr A. E. Knight,** who is well-known in the London area.

The following appointments have been made to the administrative staff of Foster Electrical Supplies Ltd., one of the Lancashire Dynamo group of companies. **Mr L. D. Gunnell,** who has been London manager for the past twenty years, has been appointed general sales manager of the company. Prior to taking over the management of the London branch he was responsible for the opening of the company's Birmingham branch, where he remained for some ten years. **Mr E. A. Ellerton,** who is responsible for internal administration, becomes commercial manager. **Mr A. C. Ball,** who has represented the company for the past thirty-one years in London and the South Eastern Counties, has been appointed London branch manager. **Mr Milton Ely,** C.B.E., continues as chairman and **Mr R. V. Ely,** M.I.E.E., M.I.MECH.E., as managing director.

An additional post of deputy director general of the G.P.O. has been created for a limited period to deal with pressure of broadcast work. It will be filled from 18 Oct. next by **Sir Ben Barnett,** K.B.E., C.B., M.C., who is now in charge of that side and will be freed to devote all his attention to broadcasting. **Sir Gordon Radley,** C.B.E., PH.D.(ENG.), M.I.E.E., engineer-in-chief, is appointed deputy director general to fill the vacancy on the permanent establishment. The Postmaster-General has also approved the appointment of **Brigadier L. H. Harris,** C.B.E., T.D., M.SC., M.I.E.E., controller of research, as engineer-in-chief in place of Sir Gordon Radley, and **Mr G. J. S. Little,** C.B.E., G.M., M.I.E.E., now assistant engineer-in-chief, as controller of research in place of Brigadier Harris. Sir Ben Barnett was educated at Christ's Hospital and Trinity College, Cambridge. He entered the Post Office in 1920, became principal in 1930; assistant secretary at Headquarters in 1939, regional director, Home Counties, in 1945; director of Inland Telecommunications in 1946, and since 1949 has been deputy director general. He was awarded the K.B.E. in 1952. Sir Gordon Radley, who was Knighted in January last, was educated at Leeds Modern School and gained technical education at Faraday Hse. After a period with Bruce Peebles and Co. he entered the G.P.O. as assistant engineer in 1920 and has since been prominently associated with the research Branch. He became controller of research in 1944, was deputy engineer-in-chief from 1949 to 1951, and from then engineer-in-chief. He is a vice-president of the I.E.E. and a past-chairman of the Measurements Section. Brigadier Harris worked in the G.P.O. Engineering Dept. from 1922 to 1939. During the war he was chief of telecommunications S.H.A.E.F. from 1943 to 1945, after which he was regional director, G.P.O. Scotland, until 1949 when he became controller of research. Mr G. J. S. Little joined the Research Section, Lines Transmission, in 1922, and became chief regional engineer, North West Region in 1939. In 1945 he was appointed staff

Sir Ben Barnett



Sir Gordon Radley

Brig L. H. Harris

Mr. E. S. Chisholm

Mr. J. R. S. Halford

Mr G. J. S. Little

engineer in the Radio Maintenance Branch, and assistant engineer-in-chief in 1947. Mr Little received the George Medal for saving from destruction by fire the Manchester Central Automatic Telephone Exchange in 1940.

To mark the completion of twenty-five years' service with his company, and as an expression of their esteem, his colleagues in the Metal Finishing Division and Laboratories have presented **Mr W. E. Wright,** a director of the Pyrene Co., Ltd., with his portrait painted by S. J. Iredale, a reproduction of which is shown alongside. Throughout his long association with the Pyrene Co. Mr Wright has been in charge of its Metal Finishing Division and claims to be the first man to promote in this country the adoption, on a fully commercial scale, of phosphate processes for rust proofing and later on for paint bondings. The portrait was painted at Mr Wright's home on the river bank at Staines and symbolises his interest in sailing. In the background is the Moth Class yacht in which his young son, Howard Wright, has had many successes in Thames Racing.

The Minister of Fuel and Power has appointed **Councillor E. G. Perry** as a member of the London Electricity Consultative Council. **Mr C. B. Curtis** and **Councillor F. Humphrey** have ceased to be members of the Council.

The Lord President of the Council has appointed **Mr E. Ashby,** D.SC., SC.D., F.L.S., **Mr S. Barratt,** B.A.,* **Professor E. A. G. Robinson,** C.M.G., O.B.E., and **Mr C. Sykes,** D.SC., F.R.S., to be members of the Advisory Council for Scientific and Industrial Research. The appointments will date from 1 Oct. **Prof R. S. Edwards, Lord Halsbury, Sir Henry Hinchliffe** and **Mr A. H. Wilson** retire from the Council on 30 Sept. next on completion of their terms of office. Mr E. Ashby is President and Vice-Chancellor of Queen's University, Belfast; Mr S. Barratt is finance director of Albright and Wilson, Ltd.; Prof E. A. G. Robinson is Professor of Economics, at Cambridge University, and Mr C. Sykes is managing director of Thomas Firth and John Brown, Ltd. It was announced in June last that Sir Hugh Beaver, M.I.C.E., M.I.CHEM.E., would succeed Sir Ian Heilbron, D.S.O., D.SC., LL.D., F.R.I.C., F.R.S., as Chairman of the Advisory Council on 1 Oct.

The Minister of Fuel and Power has appointed **Mr J. W. G. Church,** D.F.H., A.M.I.E.E., M.I.E. (India), to be a member of the Committee recently set up by him under the chairmanship of Sir Edwin Herbert to inquire into and report upon the organisation of the Electricity Supply Industry in England and Wales. This appointment follows the statement by the Minister on 30 July, that he had under consideration the addition of a qualified electrical engineer to the membership of the Committee of Inquiry. It will be recalled that such a step was advocated in the ELECTRICAL TIMES of 15 July. Mr Church has recently retired from the position of agent of the board of directors of the Calcutta Electric Supply Corporation Ltd. He was chairman of the Associated Electricity Undertakings in India and has also served on a number of important committees in India.

At the conference of the International Electrotechnical Commission which began in Philadelphia last week, **Mr C. H. E. Ridpath,** B.SC.(ENG.), A.M.I.E.E., chief electrical engineer to the Aluminium Wire and Cable Co., Ltd., of the United Kingdom delegation, took office as chairman of Technical Committee 7 on Aluminium. Mr Ridpath, who has been a member of the committee for many years, succeeds the late M. Preiswerk, of Switzerland.

To mark his retirement after 28 years service with the firm, **Mr Norman Binks,** A.M.I.E.E., electrical engineer to the Bradford and District Newspaper Co., Ltd., was presented with a wardrobe suitcase last Thursday by Mr A. R. Derwent, director and general manager of the company. Mr. Binks started with Greenwood and Batley Ltd. as an apprentice electrician, and afterwards served with T. Harding Churton and Co., Ltd., and as deputy works superintendent of the Bradford branch of the English Electric Co., Ltd., before taking up his present post. He was chairman of the Utilisation Group of the North Midland Centre of the I.E.E. in 1952-53.

Formerly district labour relations officer with the Southern Division of the B.E.A., **Mr G. O. James,** A.M.I.E.E., A.M.I.I.A., F.S.S., has now taken up a similar post for the London district of the B.E.A. His successor with the Southern Division is **B. W. Heptinstall,** who was formerly assistant to Mr James. Mr Heptinstall served for many years with the Bournemouth and Poole Electricity Supply Co., Ltd., and was a founder-member, and secretary, of the Bournemouth and Poole branch of Nalgo. He has served on the N.J.C. and D.J.C.

Mr G. Stringer has been promoted to deputy general manager of the Transport Department of Morecambe and Heysham Corporation. He was previously chief administrative assistant.

It was announced last weekend that **Mr Oliver Lyttleton,** D.S.O., M.C., is to take the title of Viscount Chandos, of Aldershot.

Mr W. M. de Majo, M.B.E., M.S.I.A., has been appointed as consultant designer to the Brades and Nash Tyzack Industries group.

OBITUARY

Mr J. Dyson, principal of the Bradford electrical wholesaling concern of that name, died on 6 Sept.

BRITISH STANDARDS

The treatment of water for land boilers. *B.S. 2486:1954. Price 6s. net.* Since its publication in 1947, the complementary volume (B.S.1170: Treatment of water for marine boilers) proved to be so valuable that the B.S.I. was pressed to provide a similar document for land boilers. This new standard is the result, but, as would be expected, it is considerably more complex due to the greater variety of land installations. Particularly directed at needs of operators of industrial steam plant, of the type usually operated at pressures up to 250 lb/sq in., the standard shows how impurities in the water affect boiler plant, assisting in the application of a suitable method of treatment.

Tapes and spools for commercial and domestic magnetic tape sound recording and reproduction. *B.S.2478:1954. Price 2s. net.* Second in the series dealing with magnetic sound recording on tape, this new standard sets out requirements for tapes and spools, specifying dimensions and certain features concerning the use of magnetic tape and spools in apparatus for normal commercial and domestic use. Information on tape dimensions and speeds is given together with requirements for dual track tape, whilst spool dimensions are specified and their nominal tape capacities tabulated.

Preferred Values and Associated Tolerances for Resistors and Capacitors for Telecommunication Equipment. *B.S.2488: 1954. Price 2s.* A series of preferred values and associated tolerances based on the "twelfth root of ten" system is set out in this standard. The tolerances considered are 5, 10 and 20%. The values given refer to both wire wound and fixed composition resistors, expressed in ohms, and to fixed capacitors, expressed in picofarads. The standard is effectively in agreement with Publication No. 63 of the International Electrotechnical Commission, which was issued in 1952.

Synthetic Resin (Phenolic) Moulding Materials. *B.S. 771:1954. Price 6s.* Small changes in levels of quality from those specified in 1948 are made in this revision. A simplified statistical technique is introduced for use in testing. Amongst the properties of moulding materials prescribed are power factor, permeability and electric strength.

Equipment for Industry

All-purpose Metal Framing

"UNISTRUT" is a new form of all-purpose metal framing manufactured by the UNISTRUT DIVISION OF SANKEY SHELDON LTD., 46 Cannon St, E.C.4. The basic section is a channel available in lengths of 10 or 20 ft and where added strength is required, various combinations are available, up to four channels being supplied as a single section. In addition to the channels, a whole range of fixing clips, straps, rollers, angle brackets are available, these are fixed together with a special bolt and nut assembly. A further section being manufactured is suitable for sinking into concrete or walls and is intended to be used for supporting pipes or conduits. By using various combinations of channels and accessories almost any racks for stores or supporting frameworks in general may be built up. Details of the range of products and ways of using "Unistrut" are contained in a new publication "Catalogue No. 1," available from the firm. In this leaflet typical arrangements of the equipment available demonstrate the versatility of the product.

Power for Tube Bending

CAPABLE of bending tubes up to 4 in. nominal bore to A.P.I. Schedule 160 (wall thickness 0·531 in.) and up to 6 in.

Shown here is the new tube-bender with tube in position for bending

nominal bore for gas and steam tubing the new machine manufactured by MAJOR, ROBINSON AND CO., LTD., Scols Works, Warwick Rd South, Manchester 16, incorporates a novel feature. Normally controlled by one electric motor with a reversing switch, speed of bending and ejection of bent tube are similar, but an extra motor may be supplied and this speeds up the reversing action. In the latter case the reversing switch is not required.

Measuring Corrosion

REPAIR and replacement of buried or immersed ferrous structures, which have become corroded, is costly, and many methods are employed to reduce corrosive effects and so protect the metal. Since corrosion is basically an electrochemical action, by measuring the electric potential between the structure and surrounding soil it is possible to obtain an accurate estimate of its location and extent. A new instrument being produced by CAMBRIDGE INSTRUMENT CO., LTD., 13 Grosvenor Place, S.W.1, specially designed for measuring corrosive voltages, comprises a high resistance "Unipivot" voltmeter and potentiometer.

In order to obtain absolute values of the small electric potentials involved, it is necessary to avoid the introduction of any instrument which takes current from the circuit for its operation. The potentiometer in the instrument is connected in series opposition with the corrosive

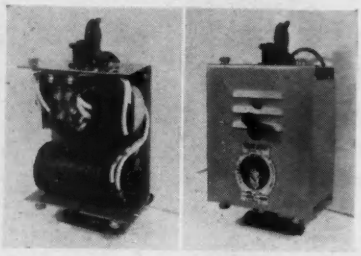
This instrument, although primarily designed for measuring corrosion, may be used as a high resistance voltmeter

voltage to be measured and by adjustment of the potentiometer a null reading is obtained on the voltmeter. At this stage no current flows in the structure-soil circuit and the voltage across the potentiometer balances the corrosive voltage. On disconnecting the instrument, the potentiometer voltage will then appear on the voltmeter thus indicating the extent of corrosion.

The instrument has two ranges 0—1·2 V and 0—5 V and resistances of 50,000 ohms and 208,000 ohms are inserted in circuit for the respective ranges. The supply for the potentiometer is obtained from a dry battery mounted within the case, which is constructed of reinforced plastic, has a carrying handle and is suitable for field use. For direct measurement, other than corrosion, in circuits of relatively low resistance, the instrument may be used as a voltmeter.

Easy Starting for Vehicles

IN cases where vehicles, of necessity, must be ready instantly to drive off, advantage might be taken of a new device which comprises a combined battery-charger and circulating-water heater. The unit is built into the vehicle and operated from normal mains. Manufactured by CALDWELL HEATERS, 448 Barking Rd, E.6, and known as the "Certstart" the unit



The "Certstart" is shown here with cover on and off, and shows neat arrangement of components

should prove of particular value to operators of fleets of vehicles and for fire service tenders. By maintaining the circulating water at normal running temperature and the battery in a fully charged state easy starting is assured. In addition longer engine life is ensured. The supplies for the water heater element and battery charging equipment are taken from a transformer and all equipment is contained in a case measuring 7 in. by 6 in. by 3 in., total weight is 8¼ lb.

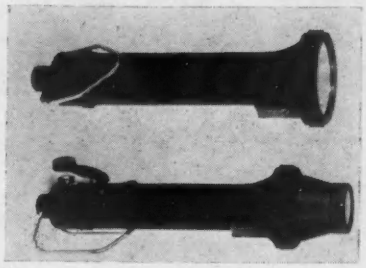
H.R.C Fuses for Switchboards

SPECIALLY designed for use on MV switchboards a new range of fuses being produced by DORMAN AND SMITH LTD., Ordsal Electrical Works, Manchester 5, have been tested for duties AC5 and DC4 at an A.S.T.A. testing station and K.E.M.A. respectively. A new leaflet issued by the firm (Publication DSQ3) gives a complete description of the fuses, which are manufactured in three ratings 30, 60 and 100 amps. From the results of the tests the firm claim that the fuses are capable of clearing faults ranging in magnitude from their minimum fusing currents up to 46 kA at 440 V a.c. Figures from tests also indicate that the fuses run fairly cool in service, those tested reached approximately 75% of maximum permissable temperature rise, and have fusing factors being 1·5 and 1·6 for all ratings. Normal cartridge fuse practice is applied in that elements are made of silver, but a feature is the low melting point rivet which is mounted in the centre of each element. At this point of fusing, the makers claim that a eutectic is formed and the final melting temperature is consequently lower than that for either the silver or the low melting point alloy used for the rivet. Porcelain fuse carriers and bases are available for all ratings and fuses are supplied with either centre or offset tags.

Doorbell for the Deaf

LONG sought after and now produced is a device enabling deaf people to have "doorbell' facilities.

This device which joins the bell circuit to the house electricity circuit is produced by SORDOVISO SWITCHGEAR LTD., Duke St, Loughborough, Leicester. It operates by a non-tilt vertical mercury switch embodying a solenoid. By depressing the



The two new G.E.C. torches referred to in the next column

bellpush the solenoid is brought into operation causing the house lighting to flash on and off. At night the device dims lighting by 70% when push is operated.

The device can be attached to telephone circuits causing the lights to flash or dim in synchronism with the ringing of the 'phone bell. We understand that the GPO has granted permission for this attachment. The company, who have a limited number on the market at the moment say that the price is in the region of £6.

TRADE PUBLICATIONS

DIESEL GENERATORS.—A leaflet featuring the inexpensive range of "Pioneer" diesel alternator sets has been issued by Petbow Ltd., Sandwich, Kent.

SPRAY PAINTING.—The Model "I.M." spray gun recently developed by B.E.N. Patents Ltd., High Wycombe, Bucks, is now described in a leaflet C.B.109, issued by the firm.

LIGHTING FITTINGS.—An interesting broadsheet folder on fluorescent fittings is available from R. and A. G. Crossland Ltd., Cartbridge Lane, Walsall.

CAPACITORS.—To help engineers select suitable power factor correction capacitors Bryce Electric Construction Co., Ltd., Kelvin Works, Hackbridge, Wallington, Surrey, have produced a technical data card from which this information can be obtained.

PUMPS.—Linatex centrifugal pumps are featured in a new brochure issued by Wilkinson Rubber Linatex Ltd., Camberley, Surrey.

METAL TREATMENT.—The properties and usage of Preperite No. 1 rust and corrosion remover is described in a handbill issued by Pyrene Co., Ltd., Metal Finishing Division, Gt. West Rd, Brentford, Middlesex.

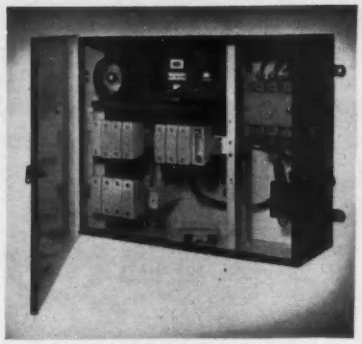
ALLOYS.—Extrusions in Hiduminium by High Duty Alloys Ltd., Slough, Bucks, are featured in a new booklet now available.

G.E.C. Heavy Duty Torches

NEWLY produced by THE GENERAL ELECTRIC CO., LTD., Magnet Hse, Kingsway, W.C.2, the BA612 Morse signalling torch is a development of the wartime G.E.C. signalling torch. It is fitted with morse key and cap. The other is for industrial applications, emergency kits, etc., and is listed as BA613. Both are two cell models.

An unusual feature is the interchangeable end caps thus permitting the use of the heavy duty torch as a signalling lamp.

Both are strongly made of die cast aluminium with black enamel crackle finish whilst reflector contacts and switch are of brass and the springs of heavily plated steel. Each torch has a space bulb and is focusable. BA612 weighs with batteries 18½ oz, is 10½ in. long and incorporates a removable blue glass filter and cowl. It costs 33s. plus 5s. 4d. BA613 weights 16 oz, with batteries, is 8½ in. long and costs 28s. 6d. plus 4s. 7d. purchase tax.



Thermodare's new control box

Thermodare Control Units

A COMPACT control unit saving labour and space in assembling and mounting a number of individual components has been designed by THERMODARE (GREAT BRITAIN), 79/80 Petty France, S.W.1, mainly for use with their space heating installations but for any other requiring time switch control.

Models and prices are as follows: HC 322 30 amp t.p. and n. Control unit with two 20 amp fuse-ways per phase £35. 10s.; HC532 50 amp t.p. and n. control unit with three 20 amp fuse ways per phase £46. 10s. HC 542 as HC 532 but with four 15 amp fuse ways per phase £48. 15s.; HC 1026 100 A t.p. and n. control unit with two 60 A fuse ways/phase £77. 15s. and HC 1033 as HC 1026 but with three 30 amp fuse ways per phase £77. 15s. Prices are nett and include carriage.

These units are housed in sheet-steel cabinets with hinged covers and provision for locking. They consist of main switch control, t.p.n. contactor, timeswitch, coil circuit fuse, pilot light and test switch, t.p.n. bank of fuses—2, 3 or 4 way as specified, Perspex circuit diagram; sealing screw for electricity board seal, cable inter-communication between main switch contactor time switch and fuses. Insulating material shrouds all live parts, and there is provision for consumer's programme clock and for master thermostat on contactor coil circuit.

For the Electrical Trade

Summer Warmth this Winter

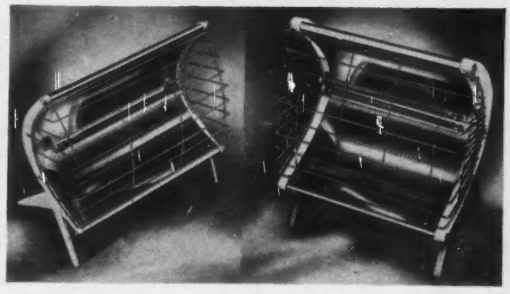
LATEST blanket by PREMIER ELECTRIC HEATERS LTD., Keeley St, Birmingham 9, is called the "Quilty" and retails at £4. 12s. 6d. plus 16s. 11d. purchase tax.

Made of strong white calico square stitched the blanket is designed to give a temperature a little above body heat and has an element designed to obviate the use of a thermostat and avoiding radio and television interference. Size is 54 in. x 30 in. Cat. No. B303 for a.c. or d.c. supplies 110/120, 200/220, 230/250 V.

Two New Ferranti Fires

TWO additions to the range of fires ready for the new season have been announced by FERRANTI LTD., Hollinwood, Lancs. Model F.4140 is a two-bar (1 or 2 kW) fire available in two finishes. Cream frame and legs in brown enamel with clear polished or Solium reflector 13 in. wide x 15¼ in. high and weighing 8¼ lb, it costs £6. 10s. 0d. plus £2. 7s. 6d. purchase tax. Model F4141 a 1 kW model has its frame finished in cream with clear polished reflector. Price is £2. 13s. 4d. plus 19s. 6d. purchase tax and dimensions 12½ in. x 11¾ in. x 7½ in. deep.

The two new season's Ferranti fires



PROBLEMS AND PRACTICE

In Engineering

It pays to check

IT is unfortunately the case with human nature that people at various times hope to benefit at the expense of others, and such instances occur more times in business than is generally appreciated. A case in point was brought to our attention when a client complained that a large glass cell battery installation, completed about a year previously by our engineers, was showing signs of deterioration not normally expected. We were held responsible for faulty equipment and free replacement was expected.

Naturally we would not accept responsibility without fullest investigation and tests were made for maximum load current, rates and periods of charging sequences, and specific gravities of cells. These values all appeared to be normal, except that the cell acid had a specific gravity rather higher than the normal average for the discharged condition. An analysis of the electrolyte was therefore made from which it was proved that a large amount of inorganic foreign matter was present. The topping up acid was analysed and found to be quite pure, but the spare distilled water was found to contain 3·36 parts/million of free ammonia, 103 parts/million of chlorine as chloride, and 1·6 parts/million of nitrogen as nitrates, whilst its acidity as sulphuric acid was 0·068% and pH value 2·1.

The latter in proportion to the remainder of constituents showed a strong acidic ionic concentration due to the presence of the above percentage of sulphuric acid. Tests with N/80 permanganate showed that the absorption rate of oxygen from the permanganate was 12·80 for four hours, indicating a high proportion of dissolved and readily oxidisable organic matter in the sample of distilled water.

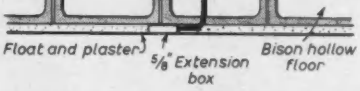
Whilst accepting that it was possible for the water to become contaminated from placing in an unclean container, the presence of a high yield of free ammonia and chlorides indicated an organic generation rather than a static combination. To verify a suspicion, a sample of rain water was taken from a nearby wood barrel into which a gutter pipe discharged, and from a similar analysis the composition of the rain water closely approximated to that of the distilled water sample. This seemed to be a logical conclusion, since the salts could have been collected from the roof slates, zinc guttering and so on whilst the ammonia could have come from the fungus growth inside the wood barrel. Therefore in this condition the water could not be suitable for use in a lead acid battery and was capable of producing a chemical deterioration over a period of time.

Every engineer has a story to tell; why not tell yours on this page? We welcome contributions to this feature, and those published will be paid for at our standard rates. Problems which are encountered and overcome in day-to-day maintenance or installation of electrical plant; useful methods and techniques developed for specific jobs, or current practices, all make instructive reading for others. We will also consider for publication problems requiring an answer. Sketches are often helpful and need only be rough, as they will be redrawn before use.

Our client, confronted by such evidence, agreed that we could not be responsible and the matter was closed, with costs for repairs payable by the client. The initial cause of trouble was false economy.—*J. R.*

Hollow Floors

ON new building work where Bison hollow floors are used, it is often difficult to install lighting points at a predetermined position, if this coincides with the edge of a block, as it is only permissible to take conduit through the hollow centre section, cutting through the edges not being allowed. Where the problem arises, the following method although perhaps not ideal, does overcome the difficulty.



This diagram suggests a method for installing lighting points below hollow brick floors

A $\frac{3}{4}$ in. extension ring with a thin box lid for a back is used to replace the conventional conduit box, a $\frac{1}{2}$ in. hole drilled in the side of the extension ring, both sides lightly reamed and $\frac{1}{2}$ in. conduit braised on. As only $\frac{3}{4}$ in. conduit can normally be used, it is advisable to leave in a draw wire. Moreover, if less than $\frac{3}{4}$ in float and plaster is to go on the ceiling it is advisable to cut lightly into the underside of the Bison block although the plasterers will usually float out to the sides of the box.—*W. Satchwill.*

Belt Stretch

I READ with interest "J.E.R.'s" article, "Common Troubles," in which he states that a new set of "vee" belts were fitted to a generator driven by a diesel engine. He also states that with a new set of "vee" belts it is not possible always to guarantee these to be of the same length and a certain amount of "stretch" takes place. To this I can only say emphatically that unless one guarantees that all belts are of the same length no proper or satisfactory adjustment can ever be made, which means continuous adjustment and a short life for the belts concerned. Your correspondent does not state if any further adjustments were made to the belt after the generator had been running for some time. Even if they were, it could never be correct or satisfactory, with the result that the state of affairs existing before the new belts were fitted would be likely to occur again. Unless the "stretch" of the belts, which takes place with all belts of this nature, is even or as near even as possible (and this can never be the case if some belts or one belt is larger at the onset) no satisfactory or proper adjustment can be made throughout the useful life of the belts. —*J. H. Robinson.*

Polarity Troubles

IT is well known that a rotary convertor can run up either with correct polarity or with reversed polarity, and for this reason, machines are fitted with a centre zero voltmeter and a field reversing switch, so that reserved polarity will be shown, and can be rectified by reversing the field. On one occasion, a rotary convertor had been down for complete overhaul, and was ready for commissioning tests. When the machine was run up to speed, the centre zero voltmeter indicated correct polarity, and a double reading test voltmeter connected across the jaws of the circuit-breaker indicated zero pressure so confirming that the machine had run up the correct way.

The circuit-breaker was, therefore, closed, and the knife switch on the negative put in, but instead of normal conditions obtaining, the circuit-breaker opened on fault issuing flames and smoke.

On examination, it was found that the wireman had connected the centre zero voltmeter incorrectly, so that when it indicated correct polarity, the machine was actually generating reversed polarity. When the double pressure voltmeter was connected across the circuit-breaker jaws it read zero pressure, since the negative knife switch had not been put in.

The lesson of this incident is to always connect the negative or the neutral before conducting any phasing-in test so that the voltmeter current will have a return path, and so that the voltmeter will indicate a p.d. even if the power connections are incorrect.—*I. G.*

Bell Circuits.—In answer to correspondence on the note under this heading in our 24 June issue, J. R. points out that he omitted to mention that the original bell installation operated unsatisfactorily due to unequal distribution of voltage in the circuit, necessitating the alteration of conditions which was made when the circuit was extended.

NEWS OF THE WEEK

B.E.A.M.A. Criticised at T.U.C.

E.T.U. President calls for Nationalisation of Engineering Industry

A PLEA for the nationalisation of the electrical engineering industry coupled with a strong criticism of the existing organisation was made at the Trades Union Congress at Brighton last Friday by Mr Frank Foulkes, President of the Electrical Trades Union. He was proposing a composite resolution in the name of five of the main unions declaring that extension of public ownership to decisive sections of the national economy was a prerequisite for the achievement of an ordered, efficient and progressive economy. The resolution was carried. The Congress was asked to confirm its support for social ownership of the basic industries, including sections of the chemical and engineering industries. Restrictive practices in civil engineering and building were criticised. Mr Foulkes stated that the heavy electrical plant industry was concentrated in large firms of established reputation, all of which could be said to be efficient from a capitalist viewpoint and all of which put shareholders' interests before the nation's. He said they were well organised within B.E.A.M.A. which exerted a strong influence on the commercial operations within the industry, and, he suspected, regulated prices to the detriment of customers. He asked that further nationalisation should be carried out during the first Parliament following the next general election.

Mr Foulkes pointed out that although the 1947 Electricity Act provided for the B.E.A.'s manufacturing plant and fittings, it also safeguarded manufacturers by prohibiting the B.E.A. from making either plant or fittings for export.

The electricity supply industry was rendering service to the manufacturers out of all proportion to the manufacturers' service to the industry, declared Mr Foulkes. He explained that the increased price of electricity to the manufacturer was only 15% over the 1948 charge, although the price of plant had increased by almost 100%, which proved that private manufacturers were benefiting more from nationalisation, than nationalisation benefited from the manufacturers, who had fallen down on demands that must have been obvious following the deterioration of plant in wartime.

Mr Foulkes insisted that programmes planned by the B.E.A. proved beyond the available capacity of manufacturers due to lack of foresight and planning. Consequently, by the end of 1948 only just over one third of the plant programme for the years 1946 to 1948 had been brought into service. While the nationalised industry gave service and made a small surplus in spite of paying interest, the largest manufacturers of electrical equipment showed exhorbitant increases in dividends.

Mr Foulkes conceded that the industry had been referred to the Monopolies Commission but insisted that it was vital and urgent for this and other industries to be brought under public control and ownership.

For the General Council, Mr W. L. Heywood said the resolution resulted from the amalgamation of several on public ownership. It covered a wide field and complete agreement could not be expected. He emphasised that the General Council would not necessarily accept all statements made by speakers, or support all proposals in the composite resolution. Mr Foulkes protested at this and said that the Council was under an obligation at least to do more than they had done in the past.

Appeal to expand Rural Electrification Schemes

THE importance of expanding rural electrification and the possibility of a Government subsidy to encourage it, was also discussed at the T.U.C. The General Council's report welcomed the progress made since Vesting-day but still felt that the B.E.A.'s allocation of £130 millions to the work during the next 10 years was less than was needed. On the question of a national tariff, the B.E.A.'s view that it was impracticable was accepted. As regards a subsidy, the view was that limitations on capital expenditure were less likely to impede progress than the Area Board's difficulties in financing projects, and it was there that a subsidy might help.

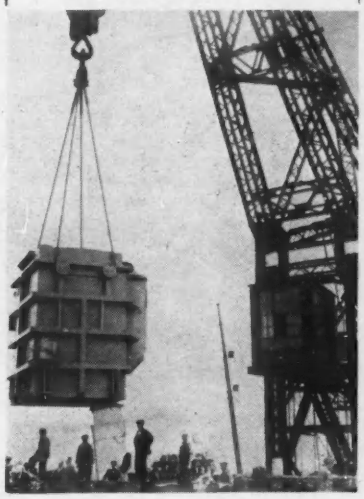
More Electric Rolling Stock for Sydney's Suburban Railways

THE long association of Metropolitan-Vickers Electrical Co., Ltd., and the N.S.W. Government Department of Railways, which has existed for some 30 years, has been continued with the recent signing of a £1 million traction order. The Department has placed an order with Metrovick through its associated company, Australian General Electric Pty. Ltd., for 80 sets of electric traction equipment. These will be for multiple-unit rolling stock comprising 80 motor coaches and 80 trailers, being built for Sydney suburban and inter-urban railways. Forty sets will operate on the new Sydney-Lithgow electrification scheme. This project includes the line from the State capital to the Blue Mountains and involves some very steep gradients.

The equipment will be designed by Metrovick and made partly at their Sheffield and Manchester works and partly by the A.G.E. works at Auburn, N.S.W. Sydney's suburban lines are operated exclusively by Metrovick equipment, some 530 sets having been supplied since 1925.

The company also has in hand the manufacture of 40 3,780 h.p. locomotives for the Blue Mountains electrification project.

U.K. Plant for America arrives in Montreal



Our photograph comes from Montreal where one of three 33,333 kVA single-phase 230,000 V generator transformers is seen being loaded aboard a railcar for the final stage of its journey to North Dakota, U.S.A. The makers, Ferranti Ltd. are supplying nine transformers to form three 100,000 kVA 3-phase banks, for the Garrison Dam project. Contract was placed by the U.S. Army Corps of Engineers and is valued at $880,000. We are indebted to Canadian National Railways for this reproduction.

Smoke Abatement Conference will hear Sir Hugh Beaver

A NUMBER of reports have been received this week on the subject of smoke abatement. Most important probably is the annual conference of the National Smoke Abatement Society, due to open at Scarborough next Wednesday (22 Sept.). Nearly 500 delegates and members are expected to attend the biggest air pollution conference yet to be held in this country. One of the conference highlights will surely be the address of Sir Hugh Beaver, chairman of the Government Committee on Air Pollution whose report is expected to be published in the next month or two. Sir Hugh will not, of course, be able to anticipate the recommendations contained in the report, but he might provide a curtain-raiser.

The Des Voeux Memorial Lecture will be delivered this year by Sir Edward Salisbury on the subject of Air Pollution and Plant Life. More technical aspects will be reviewed in papers on the industrial uses of gas and electricity. The latter will be dealt with Mr J. I. Bernard, chief technical officer of E.D.A. Another paper will concern efforts to reduce smoke from steam locomotives and developments in smokeless traction.

EIGHT-POINT PLAN

AT the conference of the Sanitary Inspectors' Association at Southport last week, Mr Alfred Wade, chief inspector at Nottingham proposed an eight-point plan to reduce smoke. He suggested that local authorities should develop smokeless estates, establish smokeless zones, appoint qualified sanitary inspectors to deal with atmospheric pollution, co-operate more closely to measure pollution, and prevent emissions from their own premises. In addition he advocated increased publicity to educate the public, the enforcement of the law relating to smoke nuisances, and the making of smoke by-laws in industrial areas. Mr Wade called on the Government to take suitable steps to abate smoke and said the problem might be solved in 20 or 30 years.

Smoke Officer

MORE atmospheric pollution tests are to be carried out in Belfast in future. The City's Health Committee last week approved the establishment of three new stations for the detection of smoke. In addition to the seven already in existence new observation posts will be set up at Victoria power station, Holywood Arches and Barnett's Park. It is understood that the Health Committee will shortly consider the appointment of a "smoke officer" whose duty would be to observe atmospheric pollution and advise industrialists on methods of reducing pollution.

Protecting Cables from Rats

DO rats eat cables? Many will remember Mr H. C. Brooking's experiments some thirty years ago with what was then called cab-tyre sheathed cable. Now, interest in this question has been revived by a Stockholm Veterinary College report recently published in a Swedish journal, which indicates that they do! A certain fussiness in diet seems also to have been demonstrated since wooden blocks took second place compared with power cables, where the lead proved to be no more than an *hors d'oeuvres* to the insulation beneath.

The rats also paid attention to the "eye appeal" of their food and luscious red and white plastic covered wires were preferred to blue. Whether colour influenced this choice or chemical in the dyestuff offended the rodent's palate is open to conjecture. Asphalt impregnated paper was regarded suspiciously, some hesitation on the rat's part being observed, though caution was thrown to the winds when chemically-treated insulating materials were sampled.

Conclusions drawn from the experiments are that neither lead nor rubber prevent rats from attacking cables and that textile-coating is specially tempting.

Commercial Travellers' Ball

OCTOBER 1 is the date selected for the Annual Ball of the Electrical Trades Commercial Travellers' Association. It will take place at the Park Lane Hotel, Piccadilly, W.1. Tickets are 37s. 6d. each and may be obtained from Mr L. A. Fickling, c/o Linolite Ltd., 118 Baker St, London, W.1.

Adaptability and convenience of a modern ironclad switchboard is suitably exemplified by this picture of an installation at the N. London premises of Glanfield Lawrence (London) Ltd., the automobile engineers. Available accommodation was limited, so much so that the side of the switchboard also forms the side of a bookcase. The switchboard was therefore designed and built specially by the General Electric Co., using their standard MW range switchfuse units throughout. Installed by the London Electricity Board, it controls all power appliances in the workshops, and the large lighting load in showrooms and offices.

E.I.B.A. REPORTS ON 1953

A SIGNIFICANT factor in the work of the Electrical Industries Benevolent Association during 1953 was the tremendous increase in the welfare work carried out. The number of cases dealt with during the year was 782, an increase of 186 on 1952, but the majority of this latter figure did not require any financial assistance. Cases in which financial help was required rose from 130 to 278. Comparison of the two years in respect of gifts bestowed on the Association's funds is favourable. There are certain decreases as regards collections at meetings but overall there was an increase of some £1,700 and the main sources of income showed an increase of over £3,400. The facts are given in the annual report for 1953 to be submitted at the annual meeting on 22 Sept.

OFFICIAL PUBLICATIONS

SCIENTIFIC POLICY. 7th annual report of Advisory Council (see page 393). H.M.S.O. 1s.

COAL MINES. Ministry of Fuel and Power Memo on Coal Mines (Mechanics and Electricians) General Regulations, 1954 (see page 398). H.M.S.O. 6d.

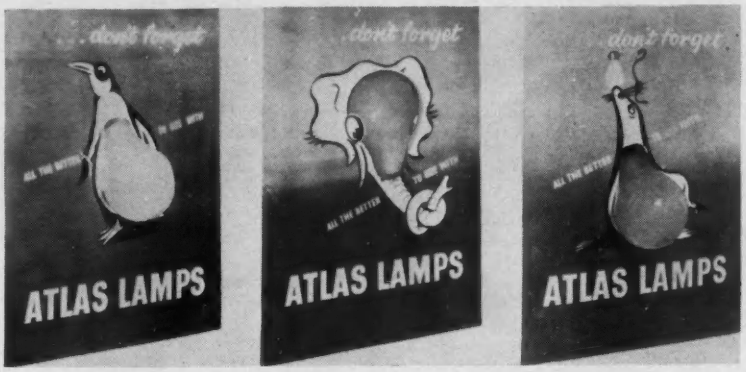
SELENIUM. Review of production, etc. by R. Ashton, E. G. Hill, and D. Neville-Jones for D.S.I.R. H.M.S.O. 1s. 6d.

News of Appliances wanted by A.E.H.A.

THE provision of advance information on new apparatus placed on the market is the object of a new series of meetings being organised by the Association of Electrical Housecraft Advisers, Common complaint among members hitherto has been that their first encounter with a new piece of equipment has been on consumers' premises. Consequently the Association is arranging discussions, lectures and demonstrations during the coming winter to try and overcome this difficulty. The first of these meetings will take place at the E.A.W. headquarters in Grosvenor Place, London, next Tuesday (21 Sept.) evening. A talk will be given on the Demonstrator and Use of Modern Appliances by Miss Taylor, senior housecraft adviser of the Eastern Electricity Board.

DO IT YOURSELF

IN THE past two autumns a series of lectures at E.A.W. headquarters on simple electrical housecraft has proved most popular among London housewives. In consequence the course is to be repeated this year and will comprise three classes to be held on Nov. 3, 10 and 17. Fee is 2s. 6d. The object is to tell women how to do the simple electrical chores like replacing a fuse or rewiring a plug top should they be alone in the house when that emergency occurs.



Three showcards produced by Thorn Electrical Industries Ltd. as part of their autumn lamp campaign due to open on 1 Oct. in which lamps have been incorporated in the shapes of animals. These and a window dressing service are being provided for retailers as well as other publicity material. They will coincide with the poster and Press advertising and the display of advertisements on buses, railways, escalator and lift panels

Expenditure of £65,000 in S.E. Scotland now finalised

IT HAS now been decided how the £65,000 obtained by the S.E. Scotland Consultative Council for rural development will be spent. At the Council's meeting last week the Area Board's recommendations for distributing this additional allocation were accepted. The distribution is to be as follows: £10,000 for Lothians, £15,000 for Fife, £10,000 for Central, and £30,000 for the Southern district. Thus the area causing the greatest concern to the Council will at least receive the largest proportion of the money.

In their letter to the Council, the Board stated they realised that the greatest need for rural development was in the southern sub-area, and it was in that sub-area that development had been accelerated and in which the Board wanted further improvement. Any further acceleration would, however, take time and it was impossible to spend all the £65,000 in those districts in the allotted time of the current financial year. Steps had already been taken to draft additional staff into the sub-area. It was intended, the letter stated, to make the Kyloe-Fenwick scheme first priority.

Mr J. M. Airlie, chairman, said he was satisfied that the Board's recommendations were the best methods of spending the money. They would be foolish to try and spend the whole sum in the southern sub-area. Mr J. Rutherford, chairman of the southern sub-area committee, did not agree with this view, however, asserting that the Board should have made adequate preparations for schemes to be put in effect immediately.

At Home with Hurseal

IMPRESSIONS of his recent tour of Scandinavian heating research establishments were given by A. C. Hazel, managing director of Hurseal Ltd at home to the trade and the Press at the Building Centre last week.

Mr Hazel said that Norway, Sweden and Denmark were engaged in joint research into heating, each country dealing with one particular facet. Denmark concentrated on standards of personal comfort in heating and concluded that the ideal combination was 50% convection, 50% radiation. In the light of this the oil-filled electric radiator was outstanding in efficiency and safety.

Regarding insulation, Mr Hazel believed that in its own interest the electrical industry should see that all parts of hot water systems and roof spaces should be insulated.

From Birmingham to Woking

ON 18 Sept., the Wandsworth Electrical Manufacturing Co., Ltd., are moving from Birmingham to Woking. Their head office and works will be at Albert Drive, Sheerwater, Woking, Surrey. Tel.: Woking 3506. A sales office, stores and distribution organisation will be located at 90 Vittoria St, Birmingham 1. Tel.: Central 8581; and the London sales office, will be at 136 Cromwell Rd, Kensington, London, S.W.7. Tel.: Fremantle 6301/2.

London's Latest Showrooms

PARTICULAR emphasis has been placed on contemporary lighting and heating equipment in the newly decorated showrooms opened by Berry's Electric Ltd. at their Newman St, London, premises. This company has long been associated with quality imitation coal fires and these are to be found now displayed with all the advantages of appropriate surroundings. With their illuminated background effect they have been arranged round the walls with all the warmth and colour that an electric fire should present as an ornamental feature in the home. The firm's latest models have been given due prominence of course, especially the small Magicoal fire with its adjustments to fit into existing grates, as shown below.

Unforgotten in these new showrooms are Berry's latest pendant lighting fittings and wall brackets to match. Indeed, overall, these showrooms set a remarkably high standard in display and will enable prospective customers to see the products to the best advantage.

The First Half-Century

The crisis some seven or eight years ago in the engineering trade of this country which led to such a disastrous strike was only the climax of two successful attempts to transfer management from owners to union officials, and to dictate who should be employed and on what terms. The same policy has been pursued in the U.S. with such success that in many trades only union men can find employment but the encroachments of the unions there, as here, grew too grievous to be borne, and there is now agitation for the open shop. An electrical firm has refused to execute an agreement to employ only union men and obtained an injunction against picketing. The appeal of the union against the injunction failed, and the Appelate Court decided that the agreement, in that it deprived the labourer or employer of the right of contract, was a violation of the constitution of the State. They also held that it violated the constitution of the U.S. as being "a contract tending to create a monopoly!—*From our issue of 15 Sept., 1904.*

Rural Electrification Talks for Three Boards

THE increasing importance and speed of development of rural electrification has necessitated more staff capable of understanding and dealing with the problems arising on the farm. Many of those drafted in to supplement the agricultural specialists on the Board's staffs are not completely conversant with those problems, and it is for them especially that a three-day course on Farm Electrification is to be held in Bristol on 21, 22 and 23 of this month. The course is believed to be the first of its kind to be arranged and is being organised by E.D.A. Some 60 members of the staffs of the Midlands, S. Wales and S. Western Boards are expected to attend at the University of Bristol's Wills Hall Hostel.

Preliminary talks will be given by Mr S. F. Steward, chairman of the S. Western Board, Mr R. A. Bayetto of E.D.A. and Mr S. R. Wragg of the University. Papers on Lighting the Farm by Mr W. Robinson, and The Importance of Sales Contacts by Mr W. J. Guscott will complete Tuesday's proceedings. Wednesday's lectures will be on Electricity in the Dairy by Mr M. M. Harvey, and Electricity for Power Applications by Mr J. T. Taylor. Two papers on Electricity for Crop Conservation and Pigs and Poultry will be given by Messrs P. G. Finn-Kelcey and W. W. Robinson on the Thursday. There will be ample time allowed during the course for discussion and questions.

Although this is the first such course to be organised, the principles might well be adopted with advantage for other areas in the country. The three Boards having the good fortune to be able to attend this course, all have urgent rural problems, but they are by no means unique in this respect. We note on page 420 the first of a series of demonstrations on farms in S. Wales.

Mirror Effect in Car Showrooms dispelled

MOTOR car showrooms invariably present lighting problems not encountered in the normal run of shop and store installations, and consequently we note an impressive scheme recently completed in the North Finchley premises of W. Harold Perry and Co., Ltd. Due to the high daylight intensity outside and the comparatively low light intensity inside a deep showroom, a mirror effect is usually achieved. To overcome this mirror effect over sixty 5 ft fluorescent lamps have been used, installed behind glass laylights and in lines behind each roof truss. The installation uses lamps and equipment supplied by Siemens Electric Lamps and Supplies Ltd., and the scheme was designed by that company in conjunction with the contractors, E. White.

Radio and Television Servicing Exams

RESULTS of the Radio and Television Servicing Certificate Examinations held earlier this year were announced last week by the Radio Trades Examination Boards and City and Guilds of London Institute. Candidates in the radio section sat at 24 centres throughout the British Isles and we note that the examination was held in Dublin for the first time this year. A total of 367 entrants sat and of this number, 143 passed, 96 were referred and 128 failed. The TV exam was taken by 104 candidates at seven centres. Fifty-five were successful and 20 referred in the practical test.

Examination Results for Demonstrators and Teachers

RESULTS of the various examinations staged by the E.A.W. earlier this year were announced last week. Diplomas in Electrical Housecraft for Demonstrators have been awarded to Mrs Bairstow and Miss B. P. Palmer of the Eastern Board and Mrs J. Best of the Yorkshire Board. The diploma for Teachers has to be awarded to Miss E. M. Reed of Wolverhampton and Staffs College. To date 473 diplomas have been awarded to demonstrators and 93 to teachers.

The fifth examination for Electrical Sales Assistants took place at 11 centres on 18 May. Thirty-two candidates gained the certificate, five with distinction, bringing the total number of holders to 149. On 19 June, the 32nd Certificate Examination for Teachers was held at five centres and 67 were successful, two gaining distinction. Certificate holders now number 1,917. Eighty candidates qualified in the similar examination for Demonstrators and Saleswomen held on 17 June at 24 centres for the 35th time. Two gained distinction, and a total of 2,154 now have this certificate.

Another Lancs Branch

INAUGURAL meeting of the Rochdale branch of E.A.W. took place last Thursday. Branch chairman is Mrs Nightingale and hon secretary, Mrs Pickup. A number of electrical and civic dignitaries were present including Rochdale's Mayoress, Mrs Pearson Lee.

New Premises for Medway College of Technology

THE necessity of the new premises for the Medway College of Technology to meet the growing demands of the Medway towns has been outstanding for many years. A comprehensive scheme was envisaged before the war but was abandoned in 1939, so that the bringing into use of the new buildings at Fort Horsted on the boundary of Rochester and Chatham last Tuesday was doubly welcomed.

The establishment is a regional college attended by up to 6,000 students, and offering degree courses in mechanical, civil and electrical engineering, as well as chemistry and physics and others. It has five main departments, not least among them being electrical engineering.

The main workshop block has an area of about 40,000 sq ft, and was planned to house the whole of the science department, the electrical engineering, metallurgy, hydraulics, metrology and research laboratories for the engineering department, science laboratory for building, lecture rooms and drawing offices. There are numerous laboratories including four for electrical engineering, a welding shop, one for machine tool testing, and one for heat treatment, and a electrical installation shop and motor trades shop. The laboratory for electrical engineering includes all types of modern a.c and d.c. machines, measuring equipment and telecommunications and radio apparatus.

Consulting engineers for the mechanical and electrical services were J. Stinton Jones and Partners, who, with the Principal, Mr C. Colles, and Departmental Heads, were also responsible for the layout of the laboratory equipment.

An excellent example of motor car showroom lighting at North Finchley.

INDUSTRIAL MAINTENANCE

A special monthly section of the Electrical Times

Maintenance in Paper Making

THE KEMSLEY MILL OF BOWATER'S LLOYD PULP AND PAPER MILLS LTD.

THE first enemy of the electrical engineer in a paper mill is water. Much of the electrical equipment is soaked at some time or another. Where water is not present, then dust appears as a trouble. Intensifying the problem of keeping the plant in good order in a large mill is a six day week for fifty weeks a year. With large paper-making machines, the cost of even a temporary shut-down far exceeds any likely cost of the organisation of effective maintenance, and planning has to be carried out with this in mind.

The purpose of the present article is to describe the electrical maintenance system in operation at the Kemsley Mill of Bowater's Lloyd Pulp and Paper Mills Ltd. It cannot be pretended that this is a typical paper mill, for it is concerned primarily with the manufacture of newsprint, and is the largest unit of the Bowater organisation and is also the largest in Europe. Moreover, as explained later, it is the only paper mill in this country to grind its own wood into pulp for paper-making purposes. Yet these facts only add to the care that has necessarily been bestowed on the evolution of an effective factory electrical organisation.

There is one aspect of the electrical work at the Kemsley Mill with which this article will not deal, however. At present, the Mill is self-sufficient as regards power generation, as there is a generating plant with a total rating of 55·75 MW, which in a recent run of 50 working weeks generated 347 million units. For the purpose of this article, the whole organisation of generation will be left out of consideration, although it obviously has a considerable influence upon the staffing of the electrical department.

There are five large paper-making machines in the Mill, and one being erected. Three of these are electrically driven by sectional drives as will be the sixth. Most of the individual motors on these machines are a.c. commutator types with ratings between 40 and 275 h.p. In addition, there are some 36 grinders, driven singly or in pairs by a motor with a rating of 1,250 or 2,500 h.p. respectively. Additionally, the large number of pumps are electrically driven. Some measure of the department's responsibilities may be gained from the following table of the motors in its charge:

13 at 2,500 h.p., 250 r.p.m.
10 at 1,250 h.p., 250 r.p.m.
2,110 at other ratings, in service.

Distribution System

The distribution system in the Mill is controlled from a control room in one of the two power houses. This controls three switchboards operating at the generating voltage, 6·6 kV. There is a 14-panel unit of Ferguson Pailin double busbar, compound filled, 350 MVA gear, a 16 panel unit having English Electric double busbar, cellular, 350 MVA gear, and a 19 panel board, again Ferguson Pailin, but this time of double busbar cellular 500 MVA gear. Reactors are installed between the switchboards so that the maximum fault capacity on most of the distribution system does not exceed 350 MVA. The 6·6 kV system is operated with its neutral point earthed through resistors.

For the purposes of 6·6 kV distribution, paper insulated cables of 0·1, 0·25 and 0·5 sq in. are mostly used. Altogether there are some 16 transformer substations, as well as some isolated transformers. The most distant important substation is that at the docks serving the Mill, and is almost 1½ miles from the main Mill.

Transformers are of various sizes, but as new installations occur, an attempt is being made to standardise on 1,250 and 2,000 and 2,750 kVA. Transformers are usually connected delta/star, and all recent units are equipped with conservators. Current practice is to provide two overload trips and earth leakage on the primary side of the transformer, with Merz-Price protection or magnetic balance across it. On the medium voltage side, the transformer is connected directly to the busbars of air circuit-breaker gear of 30 MVA rupturing capacity.

Medium voltage distribution is at 420V, three-phase, unearthed. Earth indicators are provided in all substations to give an indication of phase faults to earth, which of course do not cause automatic protective gear to operate. They connect a milliammeter with a resistance in series between each phase and earth. In some cases these indicators are provided with audible alarms. It is very seldom that an earth fault develops into one across phases, which alone can cause protective gear to operate.

Although the distribution system operates unearthed, close attention is given to the bonding of exposed metal to earth. Each building has its own earth plate, and all these are interconnected. A continuous earth bonding strip is provided in all departments, made up from 1 in. by ⅛ in. copper. All connections to this are both sweated and bolted.

Cabling is carried out mainly in paper insulated lead covered cables. Conduit is avoided wherever possible because of trouble with condensation in the moist atmosphere of a paper mill. Very extensive use is made of Pyrotenax cable throughout the factory and power plant.

In the general distribution plan adopted, a switch-fuse board follows the air circuit-breaker, and then come distribution boards. H.R.C. indicating type fuses

(English Electric) are used down to quite small sizes. The use of the same make and type of fuse throughout the Mill leads to an easier situation as regards discrimination between succeeding fuses. All distribution boards are numbered; thus P 16-21 indicates board 21 fed from transformer 16. Inside each distribution board is a schedule of circuits fed.

Electrical Department

Organisation

The head of the electrical department at Kemsley Mill has the title "Assistant Engineer, Electrical." He has one other electrical engineer as an assistant, and there are six foremen. (This summary does not take into account the power house control engineers). Fully qualified electricians are classed as electrical fitters, and their mates as labourers. They are divided into two main groups as regards working. There are 22 shift electrical fitters, who are concerned with normal maintenance operations, and 31 shift labourers to assist them. A further 18 electrical fitters are on day work, with 38 labourers, and they are primarily concerned with new installation work and with renewals and modifications to existing machines and wiring. In addition, there are three cable jointers and five apprentices. Two of the foremen are senior men and day staff and the remaining four work shift, providing 168 hour continuous cover. A small drawing office also forms part of the department.

All work of an electrical description in the Mill is undertaken by the electrical department with the sole exception of motor rewinding. It is felt that to employ skilled winders for the wide range of machines installed is uneconomic, especially in view of the spasmodic nature of fault incidence. Excellent service is in fact obtained from a large electrical repair firm.

To keep control of the work of this staff, an extensive record system has been developed, which, however, shows no signs of being worked as a system for its own sake. Considerable thought has been given to the design of the necessary stationery, and this will be described in the next section. Note may be taken here, however, of the instruction booklet issued to all members of the electrical department, and of the "permit to work" system that is in operation.

The instruction booklet contains operating instructions "intended to ensure as far as possible the safe and efficient operation of the Company's power system." It lays down clearly that at all times safety of personnel should be the prime consideration, and that all work and operations must be carried out with this in view. Subjects specifically covered include: h.v. switching procedures, the making dead of h.v. apparatus, and subsequent work on it; earthing methods; the making alive of h.v. apparatus; testing l.v. apparatus (including restrictions on types of test lamp), the locking-off of switchgear; substation practice; reporting procedure; and the permit to work system.

The permit to work system follows the usual pattern. Electrical staff down to electrical shift foremen are authorised persons for the issue of permits. In connection with the scheme, there is a full key receipt system. Most of the keys being kept at a central point. Master keys are protected by a seal which must be broken to release them. Members of the electrical department are normally exempted from the permit system for work on apparatus at voltages below 650, but it is applied for all work by contractors' men.

No separate electrical stores exists, but a member of the electrical department is employed in the general stores, and is in charge of the appropriate section.

Records and Forms

The routine paper work of the electrical department may be split into three categories: apparatus records; maintenance charts; and report sheets. It will be considered in that order.

Every item of electrical apparatus used in the Mill has a number and a record card. In general, the card records on the front details of rating and spares, and makes provision on the back for a running history of all inspection and repairs. The card for o.c.b.'s lists, for instance, position, duty voltage, maker, maker's type, description, current rating, rupturing capacity, method of operation, and where any keys needed for operation

Motor record card. Shaded sections are tabs

3457

MILL NO.	BOWATER'S LLO… …PER MILLS LIMITED KEMSLEY MILL	GEAR BOX. No.
SPARE REF. NO.	DUTY. LOCATION: DRIVETYPE. Coupling Pulley Face Diam. Crown Pinion Chain No. of Teeth Face P.C.D.	Ratio Bearings
	Issue 5. 252	Lubricant

H.P.	R.P.M.	MAKER	SER. NO.	FRAME SIZE		RAT'G.
TYPE	ENC.	S. VOLTS	S. AMPS	R. VOLTS	R. AMPS	PHASES
BRUSHES. SLIP RING.	Grade	No. per Set	Mill Ref. No.	Maker		
COMM.	"	"	"	"		
SHAFT. Extn.	Diam.	AIR GAP	WEIGHT	lbs.		
WINDINGS. STATOR. Rest. between terms.		Conn.	ROTOR. Rest. between rings			
MAKERS DWGS. Outline. No.		Sectional. No.	Shaft. No.			

BEARINGS	Type	Size
D/E		
Non D/E		
Out board		
Recommended Lubricant		

SWITCH. Form. Type No. Size
Maker Ser. No. C.T. Ratio
Amm. Range Amm. No. Prot. Dev.
STARTER. Form Type No. Size
Maker Ser. No.
FEED. Cable Fuse Type

For history see back.

Originally ordered for

PERFORMANCE				
Load	2/4	3/4	4/4	
Effy.				
P.F.				
Pull Out Torque				% FL
Mill Order No.				
Supplied				

are kept. The number, ratio, rating and service of associated c.t.'s and p.t.s are then listed, and space is provided for information on associated meters and protective devices. Appropriate information is provided for in the same way on the front of the transformer record card.

Portable tools and portable lighting leads, whose care will be discussed later in this article are treated rather differently because of the greater number of inspections that are made. Foolscap size sheets are kept in a loose leaf folder, filed according to the Mill serial number of each of these portable items. Provision is made for a note of the relevant frequency of inspection.

In dealing with motors, an ingenious method is used to overcome the difficulty of deciding if the motors should be listed in their own right, or against the machine which they drive. A card is made out for each motor, carrying information as shown in the illustration. This card makes reference to the Mill reference number which the motor bears and to the original order number. It is not filed under these numbers, however. Slits are provided in the cards to take an insert tab, and this carries a number which refers to the actual duty of the motor, e.g., "drive for No. 2 machine third drier." The cards are filed under these numbers. Slits are provided for other inserts dealing with the switches, starters and cable feeds associated with that particular position. One of these cards is shown in the illustration. There is a separate index of drive and duty details against the duty numbers.

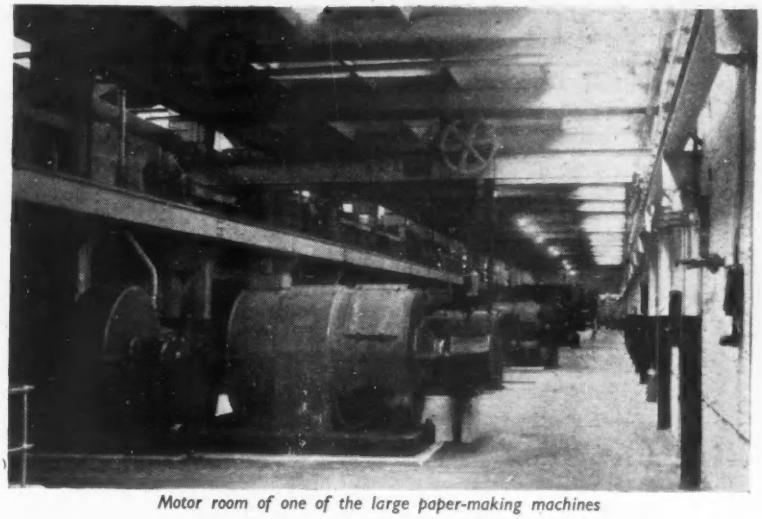
When a motor is changed the duty and starter tabs are transferred to the card belonging to the new motor, and the old card is transferred to a "spare motor" file.

Collecting information for these record cards is not left to chance. There is a standard form which is sent out to motor manufacturers when an order is placed which requests all the information required, as well as relevant drawings.

The result of this record system is that the electrical staff can at any time determine the past history of any machine, and see what information is available concerning spare parts and operating data that may be of assistance in diagnosing a fault.

Records, however, are only an adjunct to a maintenance system, and the next point to be considered is the crucial one of controlling regular inspection and periodic overhaul. This is in general in the hands of the individual foremen, since the relatively brief periods each week for which electrical equipment is accessible, combined with the continued extension of the electrical installation and frequent overtime production periods make it impracticable to lay down any precise frequency for inspection and test.

The basis of the system adopted is a series of large wall charts which are kept in substations, foremen's offices, etc., and on which are marked off all the work carried out on individual items of equipment. In the case of h.t. switchgear, a wall schedule covering three years is kept in the Mill foreman's office. As will be explained later, h.t. switchgear is inspected annually, and the wall chart provides for marking against the month of inspection the actual work carried out. Any long delay in inspection is apparent at a glance. There is a similar three year chart providing for low tension switchgear other than starters. These charts cover 168 e.h.t. circuit-breakers and 233 main c.b.s. at 420 V.



Motor room of one of the large paper-making machines

Distribution boards are listed on wall charts held one by each section of electricians; motors together with their starters are similarly treated. In the case of motors and distribution boards, each item is allocated to one of the three shifts so far as greasing, inspection and overhaul is concerned. Thus there is individual responsibility if anything goes wrong. The motor charts list the greasing periods, and provide for the record of all inspections.

Finally in this review of the paper work of the department comes the reporting system, whereby the foremen and the electrical engineer are kept informed of the state of their charge. For switchgear maintenance and testing, there is a special record form of tests taken and work carried out, which is filled up as the job is carried out. All motor and starter inspection, repair and greasing is recorded on a monthly maintenance report which gives brief details of the work completed, and which is passed through the foreman to the electrical engineer.

Shift electrical foremen make out a daily report covering all work done by day and shift staffs. On this are recorded also full details of any plant shut-down. These daily forms are provided in triplicate, one being retained by the shift foremen, one by the Mill electrical foreman, and one being passed to the electrical engineer. A special sheet is provided for Sunday, when the plant is not running, and a large amount of maintenance work is naturally carried out.

There are a number of auxiliary forms recording such matters as change in motor duties. In addition, there is a series of forms concerned with the electrical work on cranes, which will not be discussed here.

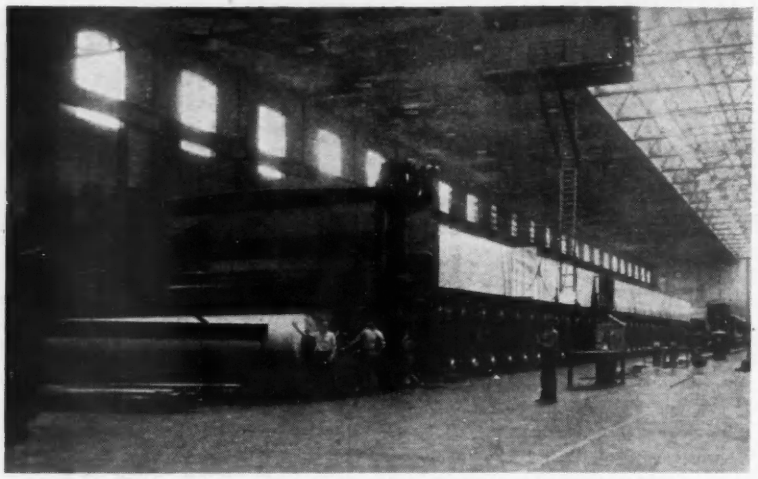
Switchgear

Now that the general organisation of the electrical maintenance system has been discussed, attention will be turned to the methods used with different types of equipment. A start may be made with switchgear, the more appropriately since this was the subject of the first organised maintenance at Kemsley Mill. It has already been noted that yearly inspection is the rule, though in the case of generator switches the period is cut to six months. Switchgear inspection is given top priority when it falls due. When a switch has been opened, general cleaning is carried out, and then tests are made of insulation resistance, a 1,000 V instrument being used, and of contact resistances, a ducter being kept for this latter measurement. When repairs have been carried out, a 1 to 5 kV electronic tester is used for testing the insulation.

Motors

Individual responsibility is the basis of the motor maintenance scheme. As already mentioned, each motor is effectively in the long-term charge of one electrician, who is responsible for its general condition. It is not reckoned practicable to remove motors and give them a thorough overhaul more frequently than once every five years, but visual inspection of all important motors is made every shift. From time to time end windings are sprayed with Endolac varnish as additional protection against water.

Because speed control is of prime importance in a paper mill, large numbers of a.c. commutator motors are used. This at once makes brush wear one of the main problems facing the maintenance engineer. Extensive investigation has led to the adoption of one or two particular grades of electrographitic brush as the



General view of large paper-making machine. Note false ceiling and roof lights

best for the particular conditions met, and this is to be reduced to one grade which will now be adopted throughout the Mill. A necessary corollary of the continuous operation of paper making machines for six days a week is the examination each Sunday of every brush on every motor. Any likely to become worn out during the following week have to be replaced. What this involves may be judged from the fact that one paper making machine drive alone has 1,600 brushes. A full record is kept of all brush replacements, so that any commutator giving trouble may be spotted. No attempt is made to true up commutators in position. If there is trouble, the rotor is removed, taken to the electrical workshop, and put on the lathe for truing. For undercutting commutators, Martindale rotating saws are used, driven by Desoutter air drills.

Large motors are protected by thermal relays (P. & B. Engineering) as a precaution against overloading. With smaller machines, some trouble has been experienced with single-phasing, particularly with pumps and fans. The trouble appears to be, that if a fuse blows in one phase, there may be sufficient fluid flow to keep the machine turning, and a burnout may occur. On all roof fans, Electrical Apparatus Co. single-phase preventors are installed. They are found to work very well.

A certain amount of trouble has been experienced with starters due to a tendency of contactors to weld in. An answer has been found in the use of contactors having resilient mountings for contacts, and in the use of appropriately designed closing coils.

Extensive experiment has led to the adoption of one grease for use throughout the factory for bearing lubrication. It is found to be suitable for both high speed and high temperature. An appropriate period is laid down for all motors to prevent their being greased too much. Greasing and motor inspection is carried out by the shift electrical fitter's mate.

So far as smaller motors are concerned, all new machines are totally enclosed fan cooled. On existing machines, where there is any danger of pipes bursting, louvre protection is provided. It has to be accepted that smaller motors may be submerged in water at times. It has been found that if they have not been subjected to any electrical loading while wet, it is usually possible to wash them out with clean water, dry them slowly, and then use them again without trouble.

Electronic Control

At present most of the control equipment, including speed regulation, used is electromagnetic, but there is already a certain amount of electronic gear, and this is being considerably extended. For the electrical department this has raised the question of how to provide the necessary maintenance. The general plan is to use men with power experience rather than import radio wiremen, and the existing staff are being encouraged to attend a course in electronics which has been arranged by the Medway College of Technology. Foremen and electrical fitters particularly concerned with electronic control systems are being sent to the manufacturers for courses. To obtain data on tube life, there is a report sheet for each individual thyratron valve. This notes its date of installation, position, when taken off circuit, and the reason.

Portable Tools

A close control is now kept on all electrical portable tools and lighting leads. Some time ago a census was taken of these items, and a number was allocated to each individual tool or lead. The number is carried on a brass washer over the flexible. One particular electrician is in charge of all apparatus of this description, and he is provided with a heavy current test set for making a test of the earth continuity conductor. He also has a vulcaniser, so that any repairs necessary to leads are made solidly. The lighter tools are supplied through 5 amp three-pin B.S. water-tight sockets at 110 V, centre-tap earthed. For heavier tools, a 30 amp Reyrolle three-pin and scraping earth socket is normal.

For use in solidly earthed positions such as boilers, 24 V sets are being provided. These consist of a double wound stepdown transformer and a special socket-outlet, and they are in the charge of the same electrical fitter. All other staff are forbidden to carry out any repairs or alterations to portable tools, or to make up new leads.

Lighting

In the main parts of the Mill, high bay lighting has of necessity to be used. However, access for maintenance is easier than is usual in such cases, because most of the machine bays are provided with a false ceiling, through which the lights project. Fittings are bolted to roof trusses. Although this leads to a certain amount of trouble due to vibration, it makes access to the fittings for lamp changing purposes much easier than if the fittings are chain suspended. In general, lamp replacement is carried out on a failure basis, and fittings are cleaned when a lamp is replaced. A particularly high general level of illumination is not of major importance in paper making. One or more men are allocated to lamp maintenance every weekend.

All lamps are supplied at 110 V centre tap earthed and for high bay lighting, the source of supply is transformers mounted in the roof. There is a mixture of gas filled tungsten and mercury lighting, and the lamps are controlled from the floor via Londex mercury relays. Extensive use is made of 5 ft daylight fluorescent lighting.

Cranes and other Equipment

The electrical department is responsible for cranes only so far as the electrical apparatus is concerned. Each Sunday one electrical fitter is allocated to examine all motors and brakes on the cranes, while the section shift electrical fitter regularly examines controllers and collector gear. An improvement in the performance of the electrical gear of cranes has been experienced since three general changes were made. These were: thruster brakes were substituted for solenoid types; wiper type controllers were replaced by cam operated designs; and a change was made to carbon shoes on all crane collectors.

Transformers are opened approximately every two years. Distribution boards are examined at least once every six months.

Power Factor and Machines

It will be noticed that in this account of the electrical system at Kemsley Mill no mention has been made of power factor correction. Although this is to some extent of less importance in view of the extent of private generation, it cannot be completely neg'ected. The correction is largely applied by the use of Scherbius phase advancing machines and Kapp vibrators in connection with the plain induction motors driving the wood grinders, and all except three of the larger motors are of the straight slip-

ring type. The exceptions are three 2,500 h.p. synchronous induction machines. The plant average power factor is 0·9 lagging.

Apprentices

Recruitment of good quality electricians is a problem for the Kemsley Mill as for most large industrial concerns. Some relief, however, is obtained by the apprenticeship scheme which has been instituted. A fully indentured five years course is organised, and a fair proportion of the apprentices stay on with the Bowater's Lloyd Co.

Recruitment of apprentices is at present limited to one a year, so at any one time there are five in the electrical department. The course offered is particularly full because not only can some power house experience be given; there is also a village of houses attached to the works and fed from its supply system, and experience can be obtained of domestic installation work here.

Nine months are spent in the mechanical workshop, and twelve on electrical fitting. Then there is a fifteen month period spent on general electrical installation work, with three months more in the Kemsley village. Drawing office work for the electrical department covers another twelve months and there are periods of three months each for cable jointing, power house work and instrument repairs. At the same time, the apprentices are granted time off to attend the local technical college.

Workshop and Stores

A well equipped electrical workshop is provided adjacent to the main mechanical maintenance workshop. Light mechanical work is carried out, and there are lathes for trueing up commutators, as mentioned in the section on motor maintenance. Provision is made for the complete testing of machines that have returned from rewinders, or are otherwise requiring full investigation. Instruments and machines are provided for determining performance characteristics and efficiency figures.

The stores, as already mentioned, are a section of the main stores, and do not call for any special description. One feature which is a time saver, however, is a board hung up near the entrance, on which are strung the more commonly required small electrical components such as contacts, all marked with their stores number. Thus the electrical fitter who requires a replacement of some part can come into the stores with the damaged component, identify it from the sample board, and so save time in obtaining the necessary replacement. For most items of electrical apparatus, the stores work to maximum and minimum stocks.

Conclusion

The impression left by an inspection of the maintenance system at the Kemsley Mill is of paper work fulfilling a purpose. Though the system of charts which has been described lacks the certainty of a rigid reminder system, working on fixed dates, it gives sufficient guarantee against neglect of any one item of apparatus. The system of reports means that the senior maintenance personnel can form opinions of the quality of different machines and types of apparatus, and they are helped in planning the great amount of new installation work which must be fitted into Sundays or into the annual holiday. Further than this, the fact that management knows what is going on has resulted, as often happens, in a good safety record. It is also worthy of note that the somewhat unusual all-insulated three-phase medium voltage distribution system seems to work excellently, and to give little trouble.

Acknowledgments

We have to thank Mr J. Ward, Resident Engineer, for permission to describe the electrical department at the Kemsley Mill, and Mr A. C. G. Witts, B.SC., A.M.I.E.E., the Electrical Engineer, for much help and assistance in the preparation of this article.

A Question of Colour

by J. Mellanby, M.A., A.M.I.E.E.

THE impending thirteenth edition of the I.E.E. Wiring Regulations will almost certainly be followed by amended versions of the Codes of Practice relating to electrical installations, so an opportunity arises of inserting some quite minor amendments which may be expected to ease the work of electricians and reduce the possibility of mistakes without adding a single penny to the cost of materials. Regulations 309-311 and Para 306 of C.P. 321 stipulate black cables or cores for neutrals, and red, white and blue for phase wires, but there are no requirements beyond red and black for the wiring of lighting circuits.

The present arrangements for conductor identification in multi-core cables are quite satisfactory, so it is suggested that the proposed alterations should apply when single-core insulated cables are installed in conduits, ducts, trunking, etc. A very high proportion of three-phase wiring in conduit is for supplies to motors, in which there is really no necessity to distinguish the phases from each other although Rule 309 calls for it; the important thing is to avoid confusion between phase and neutral. Whatever purists may say about phase sequence, the only certain way of ensuring that each motor in an installation will turn in the correct direction is by trial and error, and even if the marking of all motor and starter terminals with phase colours was made obligatory, there would be no real advantage in it. One may therefore sum up by saying that in spite of Rules 309-311, power wiring can be carried out entirely in red and black cables without any loss either of efficiency or convenience. When single-phase circuits are taken off 4-wire three-phase mains in rotation it is a convenience to be able to identify all the conductors at each junction box, but as the use of v.r.i. cables in conduit for rising mains to blocks of flats is giving place to busbar systems, this does not often occur.

With lighting wiring, however, circumstances are quite different, especially in complicated circuits involving 2-way and intermediate switches. The use of coloured cables in addition to the usual red and black simplifies such wiring enormously and many contractors have adopted conventions for their own use. The author first approached this problem over 25 years ago, and adopted the following schedule which was described in the I.E.E. Students' Quarterly Journal. The same colour scheme has also been used much later in Nigeria.

Black—Neutral to lights and plugs.
Red—Live wire to switches.
Blue—Switch wire, switch to light.
Yellow—Connecting outer terminals of 2-way switches.
Green—For a second switch wire, or elsewhere when a further distinction has to be made.

Some valid criticisms could be applied to the actual choice of colours used, such as the fact that green is now the standard colour for earth leads, but the table was drawn up at a time when earth leads were usually brown, and the colours listed were almost the only ones which were readily available on v.r.i., t.b. and c. cables without increase of price. Today, especially when bearing in mind the large range of colours possible with p.v.c. insulation, it should be a simple matter to devise a schedule that need not give rise to any possible ambiguities. There is much to be said for standardising such a table, and even if it was not made a compulsory part of the Wiring Rules it could be added as an Appendix to the Code of Practice and its use made voluntary. The point in question today is whether the revised Rules will acknowledge the use of colours as an aid to efficiency, or whether wiremen will be expected to go on as before and sort themselves out by cutting nicks and tying knots in a multitude of "reds," while "blacks" are compelled to be permanently neutral.

REFERENCES

Modern Electric Wiring. I.E.E. Students Quarterly Journal, April, 1931.
Wiring in Nigeria. ELECTRICAL TIMES, 6 Sept., 1951.

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Terminal Markings for Foreign Motors

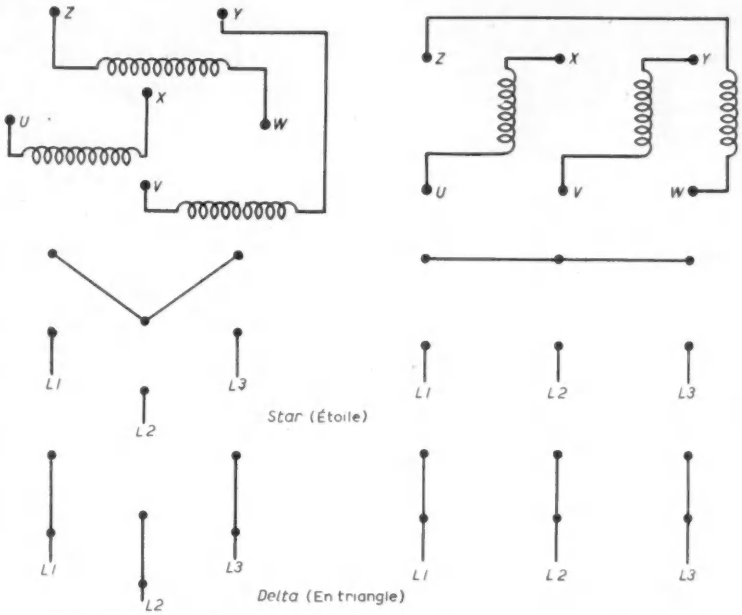
DATA SHEET 9

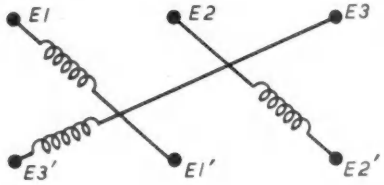
STANDARD terminal markings on foreign motors not unnaturally differ considerably from those used in this country. In this Data Sheet the markings used on French, Italian and, finally, German machines are illustrated. Some of the equivalent technical terms in these languages are given, since they may be useful in determining the details of a motor which has to be connected or repaired.

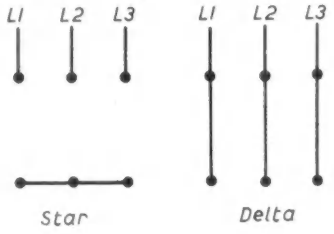
I.—FRENCH MACHINES

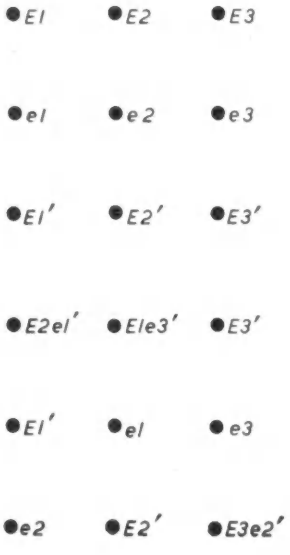
The diagrams on the right are taken from the French Standards publication NFC 51-102 "Normal three-phase induction motors in general use—medium ratings."

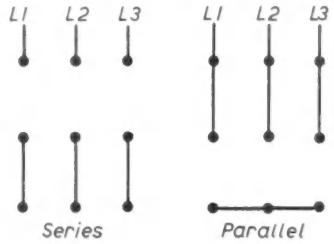
Junction boxes are of two types, and they are provided with shorting links for the change from star to delta. These are shown reading vertically from the top of the diagrams. The centre connections are for star (*étoile*) and the lower for delta (*en triangle*) running.

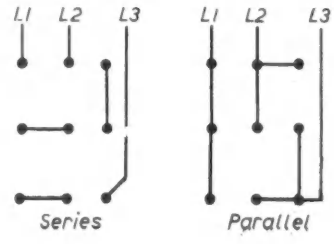










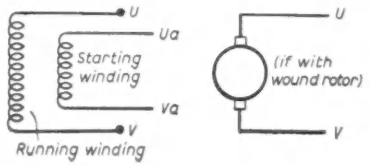


Left is seen the terminal arrangement used as an alternative on some French three-phase machines. (Information supplied by Delfosse). From top to bottom there are a star-delta connection, a series-parallel arrangement, and a second series parallel terminal arrangement. The figures given may in fact appear as inferior letters, e.g. E_1.

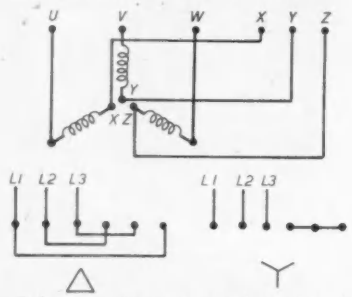
Some early French machines may be found marked as shown in the diagram immediately below.

Single-Phase Motors. There appears to be no standard markings for single-phase machines. Some machines adopt German markings (see overleaf) or the Dutch markings shown below.

The abbreviation D is sometimes used for starting (position of switch); N for running.

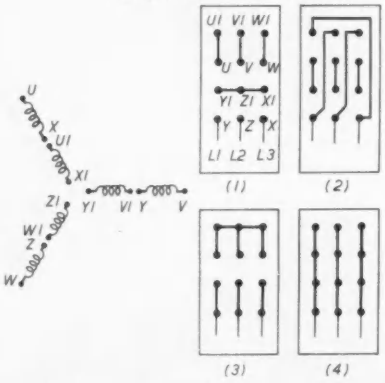


II.—ITALIAN MACHINES

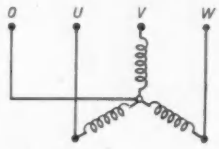


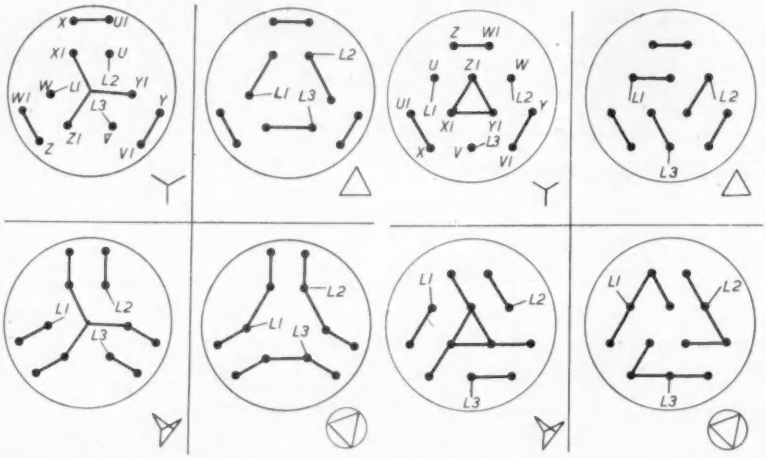
Below are shown connections given in a standard Italian reference book. The actual terminal plate arrangements are shown to the right of the sketch.

(1) Star—Italian *stella.*
(2) Delta—Italian *triangolo.*
(3) Parallel star—Italian *doppia stella.*
(4) Parallel delta—Italian *doppia triangolo.*



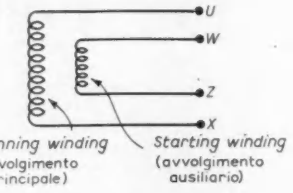
The connections shown on the left are from a tentative Italian standard. (UNEL Pr 12-13, 1949). They are not yet officially adopted. Except for the terminal arrangement, they are similar to the German. They apply to a motor arranged for star-delta starting. The terminal markings for a permanently connected star motor are given immediately below.





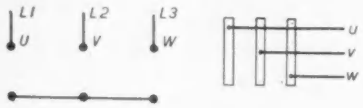
The information above illustrates a circular terminal box similar to those in use in America. The four diagrams, in each set represent star, delta, parallel delta, and parallel star respectively, reading clockwise from top left. The connection on the right is that used on some Marelli motors.

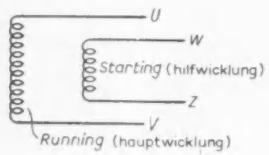
For single-phase Italian motors, the lettering shown below is usual. D.C. standard connections are specified in publications UNEL Pr 12-13 and UNEL 06011. They are generally similar to the German connections to be given later.



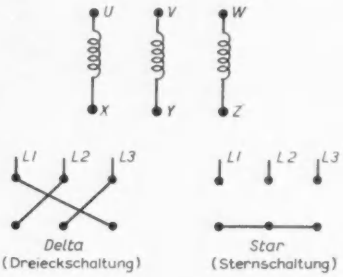
III.—GERMAN MACHINES

On the right are shown standard German terminal arrangements and lettering for three-phase motors. For a three-phase slip-ring machine, the lettering is that shown immediately below this text. Below that is given the lettering for a single-phase (*einphasen*) motor.





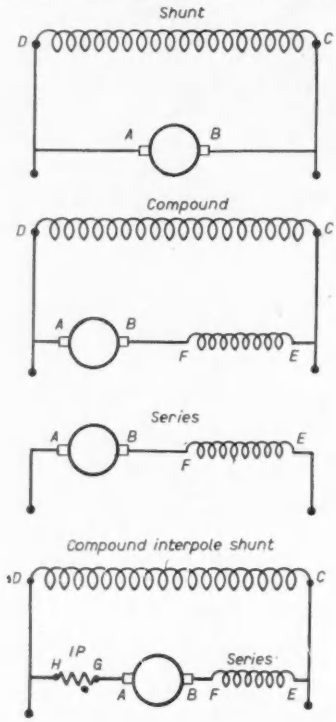
The lettering for this single phase motor shown immediately above also applies to certain French machines (see page 31).



Information on the German standard markings given in this section was obtained from various publications of the *Verband Deutscher Electrotechniker* (V.D.E.). Amongst other abbreviations which may be noted as standardised are:

D.C.—G
1-phase—E.
2-phase—Z.
3-phase—D.
6-phase—S.
Short-time rating—KB or DKB.
Intermittent rating—AB or DAB.

On the right are shown the terminal markings used on various types of d.c. machines in Germany.



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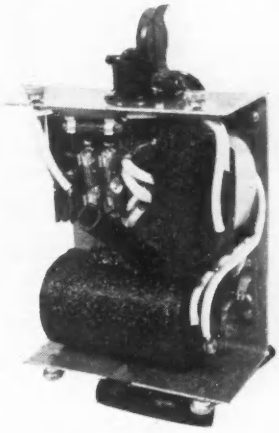

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Commissioning and Testing
POWER TRANSFORMERS

By a Steelworks Electrical Engineer

BECAUSE it is a static piece of apparatus, the transformer is inherently a most reliable piece of electrical equipment. Some care, however, is needed when a unit is put into operation for the first time, particularly if it is to operate in parallel with other temperatures. In the last article, transformer equipment was discussed, together with methods of phasing out with one or two transformers. Some further topics now require consideration.

Alteration of external connections

The interchange of two connections on the l.v. side of a transformer will result in reversed phase rotation; the interchange of two connections on the h.v. side of the transformer will have the same effect on the l.v. phase rotation, and may also cause a change in the phase shift across the transformer. In the examples illustrated below the transformer is assumed to be connected to h.v. busbars R, Y, and B whose phase rotation is correct; the l.v. terminals are connected to busbars R′, Y′, and B′, whose phasing and phase rotation will be fixed by the transformer connections themselves. The vectors represent the induced voltages on either side.

Fig. 5 (a) shows a Dy1 transformer correctly connected; the dotted lines in the upper vector diagram represent, to some scale, the voltages across each of the h.v. phase windings. Since these are displaced by 30° to the h.v. vectors R, Y and B, it follows that the induced secondary e.m.f.s. will have a similar displacement and the secondary voltages R′, Y′ and B′ will be as shown. If terminals a_2 and b_2 were connected to the Y′ and R′ busbars respectively instead of as shown, the result would be that the vector marked R′ on the diagram would become Y′, and Y′ would become R′, i.e., the order of rise of voltages would be Y′R′B′ instead of R′Y′B′, and the rotation would in effect be reversed.

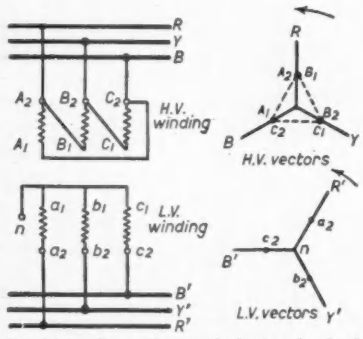


Fig. 5(a). Connections and phasing for Dy 1 transformer

Fig. 5 (b) shows the same transformer with two of the h.v. connections interchanged; the R Y and B vectors still come up in the correct order but the voltages across the individual phase windings on the h.v. side are now altered. The result is that the l.v. voltages now come up in the order R′ B′ Y′, i.e., reversed rotation, and also the l.v. star of voltages has been "turned round" as compared with Fig. 5 (a). In Fig. 5 (c) the effect of interchanging corresponding connections on both the h.v. and l.v. sides is shown, and it will be seen that the position of the l.v. star is the same as in Fig. 5 (b), but the phase rotation has now been corrected and the voltages come up in the right order R′ Y′ B′. The R′ vector is now displaced by +30° relative to the R vector and so the transformer is in effect a Dy11 unit. By drawing vector diagrams in a similar way it can be seen that any transformer which has a 30° phase shift across it in one direction can be re-connected externally to have a 30° phase shift in the other direction, thus if the voltage ratios are the same any delta/star, star/delta or star/interstar transformer can be paralleled with any other irrespective of whether they be designed for the 1 o'clock or 11 o'clock phase shift.

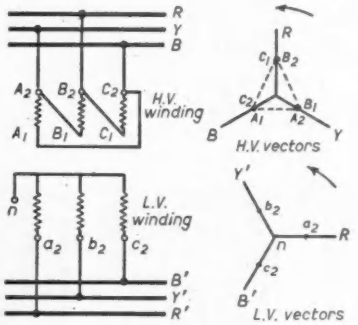


Fig. 5(b). Dy 1 transformer with R and Y connections reversed

Fig. 6 (a) shows similarly the connections of a Yy 0 transformer and Fig. 6 (b) the effect of interchanging two of the h.v. leads; this results in a corresponding change on the l.v. side and reversed phase rotation. If now two of the l.v. connections were also interchanged the rotation would become correct and the phasing be once more Yy 0. Fig. 7 shows the connections of a Yy 6 transformer, and it will be apparent that no re-arrangement of external connections will make this unit parallel with a Yy 0 transformer because opposite ends of the l.v. windings are brought out in the two cases; similar remarks apply to delta/delta and delta/interstar transformers. In practice if a transformer of 0° phase displacement has to be paralleled with one of 180° displace-

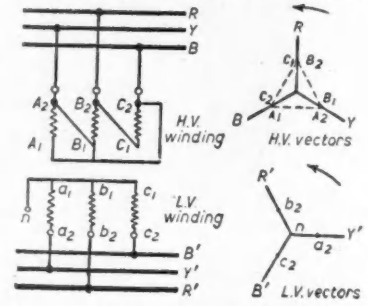


Fig. 5(c). Dy 1 transformer with corresponding connections on h.v. and l.v. sides reversed

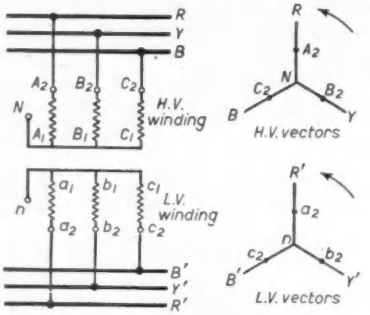
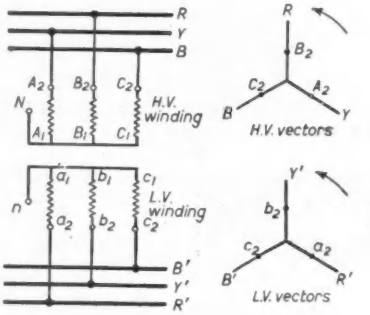


Fig. 6(a), above, shows connections and phasing for a Yy0 transformer: Fig. 6(b), below, is for the same transformer with R and Y connections reversed



This article is the third in a series "Commissioning and Testing Plant" which commenced in "Industrial Maintenance" on 24 June, 1954. The second article appeared with the issue of 19 Aug., 1954.

ment, it will be necessary to lift the windings from the tank and rearrange the internal connections.

Transformers to BSS 171 1927

Fig. 8 illustrates a transformer whose internal connections are identical to those of Fig. 5 (a), but lettered according to the 1927 edition of BSS 171, and with busbar connections made in accordance with this British Standard. The relative positions of the vectors of induced voltage are, of course, the same in both cases

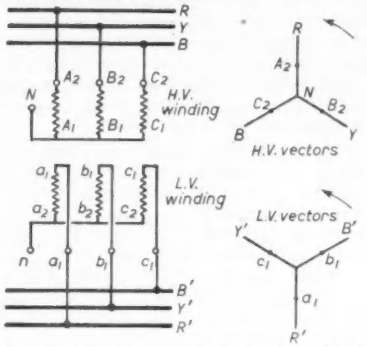


Fig. 7. Connections and phases for a Yy 6 transformer

but the order of lettering differs, with the result that the phase shift across the transformer is $+90°$ and the vector reference Dy 9, instead of $-30°$ and Dy 1 for the 1936 transformer.

If a modern Dy 1 transformer were to be introduced into a system phased according to the 1927 convention, its terminals a_2 b_2 and c_2 (as shown in Fig. 5 (a)) would have to be connected respectively to the yellow, blue and red phases. The preferable course of action would, however, be to alter the connections of the old transformer to bring it into line with present-day practice; this may mean a considerable amount of work, but the

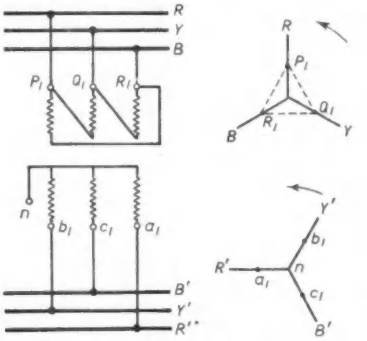


Fig. 8. Dy 9 transformer to the 1927 specification

alternative of perpetuating an obsolete system can only lead to confusion and mistakes.

Transformer troubles

The absence of rotating parts makes the forced outage of a transformer a rare occurrence, and such work as is required is generally in connection with the oil system or on-load tap changer if fitted. The electric strength of transformer oil is very susceptible to the presence of moisture or fibrous material, and care should be exercised when opening the oil system to prevent the ingress of foreign matter; the use of dehydrating breathers will assist in avoiding condensation inside conservator tanks and an annual check of the dielectric strength is a desirable routine. Another source of oil trouble lies in the tendency to sludging and acidity, the two effects often appearing together; the working temperature of the oil and the type of atmosphere play a large part in determining whether an oil will go acid or not. An acidity value of less than 0·5 mg:KOH per gram of oil can be accepted as satisfactory, and a figure of 1 mg/gm should be taken as an indication that the acidity is excessive. A high value of acidity will cause corrosion of the tank and metalwork above oil level, and also increase the tendency to sludging in the oil. Sludging will also be accentuated if the transformer is consistently operated at temperatures above about 70° C, the result being the deposit of solid material on the bottom of the tank, on the core and on the windings. Some of the sludge is drawn into the oil ways in the core and windings by the circulation of the oil and the resultant blockages restrict the flow, increase the temperature and thus cause a progressive deterioration. The sludge itself is strongly acid and, if left alone will raise the general acidity level of the whole oil system.

If sludging occurs the only satisfactory solution is to drain and clean the tank and to remove the core and windings to clean the deposit off them; a good method of carrying out the latter is to use warm clean oil under pressure, the jet being directed through the oil ducts of the transformer. The sludge tends to harden when exposed to the atmosphere and it is therefore doubly undesirable to have the windings out of the oil for longer than necessary. Filtration or centrifuging of the oil will remove water, sludge or fibrous material but will not, in general, have much effect on the acidity; if the oil is acid nothing can be done on site to improve it, and the manufacturer's works will be the only place with reconditioning facilities.

The troubles associated with on-load tap changers are those common to all forms of switchgear, and have been outlined earlier. An annual inspection of the diverter switches should be regarded as a minimum maintenance requirement, and more frequent overhauls may be desirable if the unit is being frequently operated.

Some Points about the Electricity Regulations

Part 8

by H. W. SWANN, O.B.E., D.F.H., M.I.E.E.

AT the end of the last article in this series on the Electricity Regulations 1908 and 1944, I was discussing the problems which the growing use of electronic gear in factories introduce with reference to the interpretation of the Regulations, so far as maintenance is concerned. It is Regulation 1 which requires, effectively, that "things shall be so *maintained* as to prevent danger, if reasonably possible."

Constructional Standards

On another side of the work associated with my late job, I have had to look into the question of fires caused by television and radio receivers on domestic premises and one point which has been noticeable is the great difference between the standard of construction of an amplifier made to a customer's technical specification, e.g. the Royal Navy or the G.P.O. and one built to sell in a highly competitive market to a non-technical purchaser concerned only with price and performance. There is, of course, nothing new about this—there are different classes in most markets—but whereas some hundreds of fires are caused each year by defects in ordinary radio receivers the Engineering Department of the G.P.O. told me, after enquiry, that they were almost entirely free from trouble of that sort in their numerous establishments. In so far as manufacturing design is guided by experience in service it is likely that as industrial maintenance engineers acquire increasing knowledge of the behaviour of their electronic applications they will accompany their enquiries for new equipment by specifications which will in time I hope tend towards higher insulation levels and more robust components with some attention to automatic protective devices of the thermal or other suitable character. It would be difficult to overestimate the value of B.S.I. specifications in this connection.

> ELECTRICITY REGULATIONS 1908 AND 1944: DUTIES CLAUSE
>
> It shall be the duty of the occupier to comply with these Regulations. And it shall be the duty of all agents, workmen, and persons employed to conduct their work in accordance with these Regulations.

Readers of this and earlier instalments may remember that I have based these notes on the three salient features of Regulation 1—adequacy, safe operation and maintenance. I have dealt with a number of aspects of each feature so that the wide implications of the Regulation may be realised and those who have to carry them out may measure the extent

of their responsibilities. The all embracing style of the Regulation is adopted again in the Duties Clause which lays the obligation of observance on everybody concerned and is possibly the best thing of its kind since Nelson's signal to the Fleet at Trafalgar. But whereas the requirements of the Regulation are restricted by the proviso to things which are reasonably practicable, occupiers and workpeople alike are expected to do their duty under the Clause without reservation. Thus they must "conduct their work in accordance with these Regulations" without being able to take refuge in any kindly proviso such as "for far as they are understandable."

The relative responsibilities, as between occupiers and other persons, are sorted out in Sections 136 and 137 of the Factories Act 1937 which give power to proceed against the actual offender. Under Sub-section 137 (1) an occupier who has been summoned to Court may cross-summon any other person whom he regards as the actual offender and if he can satisfy the Court on the point the other man has to pay if there is a conviction. Under Sub-section (2) an inspector can by-pass the occupier, if he thinks him blameless, and proceed against the person who did it if he knows who it was.

In factory law practice most of the cases which go to Court involve the occupier who is generally a limited company, or similar impersonal organisation which can sin only through the misdeeds of its servants. There are however from time to time examples of gross carelessness, or even disobedience, on the part of persons employed which lead to accidents to others, and where such a case involves disregard of well-understood rules for safety, an inspector may exercise his power of selection and charge the person concerned with an offence under the Regulation which he thinks appropriate.

> ELECTRICITY REGULATIONS 1908 AND 1944: REGULATION 2.
> All conductors shall either be covered with insulating material and further efficiently protected where necessary to prevent danger, or they shall be so placed and safeguarded as to prevent danger so far as is reasonably practicable.

I have sometimes thought that Regulation 2 must have been the one that Swinburn's committee started on whilst they were fresh. The phrase "to prevent danger" appears twice in two lines as a prelude to the "reasonably practicable" tag which shows that they were prepared to deal resolutely with "all conductors". which no doubt they properly regarded as the genesis of electrical working. It was probably drafted as three separate requirements dealing respectively with the insulation of the conductor, preventing it from being knocked about, and dispensing with it where the conductor was out of reach. Although these three points have been grouped in one clause they represent the intention of the Regulation which was drafted at a time when 11 kV was the highest voltage in general use and rubber covered tail ends were the common form of connection between cable boxes and circuit-breakers, transformers or other equipment.

Before I started inspecting I had been used to working in the vicinity of 11 kV rubber insulated conductors and to the curious sensation of the hair seeming to stand on end when it touched the outer braiding. I was therefore surprised to learn after joining the Department, of cases where people had been hurt, or killed, by touching insulation which had deteriorated or been damaged and I also found that a good many engineers were reinforcing it with yellow cambric tape. But here some of them went wrong because although tape, served over a straight run of cable, was remarkably effective the insulation value fell considerably if the jointer afterwards set the cable, as he usually did, in order to bend it into position. In some places also the cables were made off into sockets with a bolted attachment to terminals and effective insulation by tape was most difficult owing to the contours and sharp edges which cracked the varnish in the cambric. For these reasons we took the view that metal sheathing or metal covers were required by the Regulation as further measures to prevent danger, and this has led to the present day practice of direct mounted end boxes for most types of high voltage equipment and, in a good many cases, for medium pressure assemblies also.

Building Contracts

It has always been difficult to apply this requirement of further protection to temporary installations for building contracts although under the conditions which obtain the insulation of the wires and cables, strung up all over the place, is more likely to be damaged than in most other conditions of use. I once counted 15 places in 27 ft of wire where the insulation had been "made good" with black tape.

I have referred to an earlier note to the legal difficulties of enforcement of the regulations on building contracts and works of engineering construction but when accidents occurred I tried to turn them into useful account by persuading the contractors to install transformers for 110 V to offset the risk from temporary wiring. The larger firms found this reasonably practicable in a number of cases but the smaller ones looked at the first cost of transformers, although I tried to get them regarded as part of the regular building plant and tools normally transported from place to place. It was not suggested that supply for fixed and heavy equipment, such as jib cranes and mixing plant, should be transformed, but there was a strong case for voltage reduction in the use of hand tools and for temporary lighting. At values of less than 125 V Exemption (1) becomes operative and the Regulation ceases to apply—an attraction which is enhanced by the fact that the lamps last longer for more reasons than one.

Although during the years of war the move towards voltage reduction was largely submerged by circumstances the efforts since made to revive interest have not been unsuccessful and have received a large measure of support from the B.E.A. and their electrical consultants. In the case of one large power station contract, which I visited myself, I found that supply at 110 V had been made available at a number of points for hand tools and portable lamps and the individual contractors were using it. They were encouraged to do this by the fact that supply at 240 V was withheld except for fixed equipment but in another case the contractors just said they had no 110 V equipment and would wait until it could be obtained or until 240 V supply became available.

These big building contracts often involve a large number of such contractors some of whom find the ubiquitous lamp holder a great convenience. A B.E.A. engineer responsible for looking after the electrical side of a major contract, told me that he carried insulated pliers for cutting these leads, and that some sub-contractors seemed to have enough wire to reach the nether regions.

O.H. Lines and Jibs

Not so long ago I was walking along the roadway of a very large plant under construction, with members of the electrical staff. I commented on the number of overhead lines, wires and cables and enquired how the various types of run abouts fitted with lifting jibs managed to keep clear of them. The first answer, which came at once, and from the heart, was—"they don't"—and although this was quickly qualified by an afterthought, I was left with the feeling that the overhead network was not "so placed and safeguarded" as required by the Regulation. I gathered that the troubles arose mostly during night working but although they were frequent no accidents had resulted. Most of these vehicles had rubber tyres and on questioning a young driver, who admitted having fouled a line more than once, he told me that when it happened he either "stayed put" or "jumped clean away" and that his mates adopted the same procedure. Apparently, the driving fraternity had learned from experience that their vehicles would be live unless they could drive them clear of the lines and that it was best to avoid hand holds if they had to get off. Not everyone, however, is given the chance of learning and there have been many fatalities over the years, seventeen in connection with jib cranes. In a remarkable case where a jib was driven into a high voltage line, the wet and muddy walls of the wheel tyres carried enough surface leakage current to set the rubber on fire. The petrol tank was burst by the heat and when the fire was over, an accident occurred to a man in the potential gradient which radiated from the vehicle.

(To be concluded)

FOUNDATION STONE LAID FOR MARCHWOOD

VISITORS to Britain in the near future will be greeted by two impressive symbols of the industrial might of the country, Fawley Refinery and the new Marchwood Power Station. This point was emphasised by His Grace the Duke of Wellington, the Lord Lieutenant of Hampshire, when he laid the foundation stone of the station on Wednesday, 8 Sept.

His Grace was introduced by Mr R. H. Coates, Controller of the B.E.A. Southern Division, who commented that while to many it might seem unusual to have a foundation stone laying ceremony when much of the steelwork had been erected, it should be remembered that in ship launching ceremonies, the outfitting of the ship had still to be carried out. His Grace, who is Chancellor of Southampton University, also referred to the fact that both Fawley Refinery and Marchwood would be fed with technical staff derived from the University.

Sir Henry Self proposed a vote of thanks to the Lord Lieutenant and had some words to say on the size of the B.E.A. programme and the financial implications involved. A silver trowel was presented to the Duke of Wellington as a memento of the occasion.

Liverpool's £600,000 Plan for Better Street Lights

A £600,000 programme has been drawn up by Liverpool's Lighting Committee for the conversion of the city's street lights from gas to electricity. It is proposed that the whole conversion will be carried out simultaneously. Outside the central redevelopment area the work is to be completed in ten years, and inside the area within 15 years. The possibility of finishing it in five years was not possible.

The proposed scheme provides for the installation of some 15,000 electric lighting units to replace the existing 12,000 gas positions. The committee has been told that to carry out the task in five years, as had been previously suggested, an average of 3,000 lamps a year would have to be installed, whereas the Merseyside and N. Wales Electricity Board could guarantee no more than half that number in the time. The City Lighting Department also wants to complete the fittings themselves after the Board have installed the service, and the Department had not the resources to carry out a 5-year programme. They maintained that the employment of contractors would cost £4 per lamp extra. Under the scheme, the Committee is seeking to replace every three gas lamps (excluding passages) by five electric lamps and to improve a number of roads from group B to group A lighting, thus providing the city with a far better system of lighting.

Two Answers for Concrete Column Critics

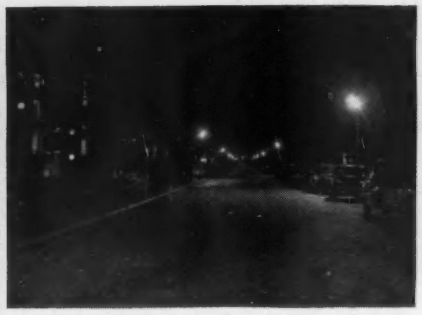
THERE has been plenty of criticism levelled against the concrete street lighting column in the past on the grounds that it destroyed many of the amenities of our more picturesque towns. The answer to those critics has been suitably provided by installations carried out recently at Bury St. Edmunds and Haddington. No columns obstruct the narrow pavements of the town centre at Bury St. Edmunds, nor do they clash with the mellow toned buildings. Instead, discreet designs of wall brackets have been placed unobtrusively and carry lanterns of simple but pleasant design. Choice of lamps fell on 500 W tungsten lamps mounted at a height of 25 ft and some 120 ft apart. All equipment was supplied by Crompton Parkinson Ltd., the lantern selected being their Lion S401 DV; and the installation was carried out by the Eastern Electricity Board.

The same principle was adopted by the S.E. Scotland Electricity Board in their installation for Haddington (E. Lothian) town council, although the width of the roads sometimes exceeded 70 ft there. The scheme, inaugurated on 30 Aug., consists of 28 Revo Electric C.31112 vertical wall mounted fluorescent lanterns each housing three Philips Electrical 80 W high efficiency warm white hot cathode fluorescent tubes. Lantern canopy and frame are of cast aluminium reinforced with three steel tubes. Internal reflectors are of polished stainless steel and outer covers of partially reeded clear perspex. Lanterns are spaced some 80 ft apart and fixed at a height of 21 ft.

A good effect of this method of street light is that it enables objects to be seen naturally by shape and colour rather than two dimensionally. It has numerous other advantages, such as freedom from colour distortion, absence of glare, ease of maintenance by ladders instead of towers, less vibration and lower upkeep costs, and the comparatively low load, which in this case is about 300 W for each lantern.

Unobtrusive wall brackets and simple fittings enhance the night scene in Bury St. Edmunds' narrow streets. Wall-mounted fittings provide entirely adequate illumination over the wide roads (top) of Haddington.

Shenton Way (left) and the Tiong Bahru Rd are two of the most recent additions to the fluorescent lighting installations in Singapore.



More Lighting in Singapore

SINGAPORE has already laid its claim to being the best-lit city in S.E. Asia, and among the latest installations to be carried out were in the Tiong Bahru area, Alexandra Rd and Shenton Way. In the first two schemes 2 ft fluorescent lanterns housing 40 W tubes were employed. Notable feature of those two schemes was the use of twin armed columns. In Shenton Way the fluorescent lanterns each houses three 5 ft lamps. The equipment was supplied by the British Thomson-Houston Co., Ltd., which company has now provided Malaya with some £12,000 worth of apparatus since the war.

NEWS IN BRIEF

Another stage of the French Railways' programme of electrification in Upper Savoy has been completed with the introduction of electric traction between La Roche-sur-Faron and Annemass, three miles from Geneva.

We hear that Stewarts and Lloyds Ltd. propose to close their Swansea steel works in six months' time The company's new plant at Corby is said to have rendered their Swansea works redundant.

Electrical alterations have been completed at Suleskerry lighthouse, near Orkney. Three new diesel generators have been installed and two new radio beacons.

Lists of publications, films, film strips and wall charts have been produced in booklet form by the Aluminium Development Association.

Edinburgh branch of E.A.W. will celebrate their silver jubilee next month with a number of special events including dinner at Adam Rooms, George St.

West Midland businessmen will question M.E.B. officials on electricity charges at the Chamber of Trade council meeting next Thursday (23 Sept.).

A course on Personnel Management Practice is to be held at Morley College, 61 Westminster Bridge Rd, S.E.1, on Tuesday evenings between 28 Sept. and 7 Dec.

Fully illustrated brochures giving details of the College of Production Technology at Swinford Old Manor, Ashford, Kent, together with a calendar of events. We note the College has extended its courses on Materials Handling and Work Study at its new premises at Charing.

First of a series of demonstrations and lectures on Electricity on the Farm, sponsored by the S. Wales Country Landowners' Association with the S. Wales Electricity Board, took place earlier this month. Falcondale Home Farm, Lampeter, was placed at the organiser's disposal for the occasion by the association's vice-chairman.

Sayings OF THE WEEK

"The most heartening feature of the committee's work has been the active co-operation of manufacturers of lamp-posts or lighting columns." . . . Editorial in DESIGN commenting on the C.o.I.D. Street Furniture Committee..

"Unfortunately, a very large number of our firms, indeed, probably the larger proportion, are so poorly equipped with scientific staff and library facilities that they hardly know what new research is waiting to be exploited in their own industrial fields." . . . From the Report of the Advisory Council on Scientific Policy.

"If the direction of our engineering companies lacks something of the skill and initiative of fifty years ago when we led the world, then the engineers with vision and personality should be in demand to fill this gap." . . . MR B. MONCK, speaking at the British association meeting at Oxford.

ELECTRIC SUPPLY NEWS

Blyth

The Town Council is objecting to the proposed system of ash disposal to be used by the B.E.A. when Blyth's new power station is built. The B.E.A. proposes pumping ash into the sea with the outlet of circulating water but the Council is concerned about the possible effect on the town's beaches. It is suggested as an alternative that ash should be taken by barge and dumped some miles out to sea to avoid any effect on the beaches.

Dolgelly

The B.E.A.'s proposals to promote a Parliamentary Bill to obtain powers to enable them to proceed with the construction of a pumped storage hydro-electric scheme near Blaenau Ffestiniog (to which we referred on 3 Sept.), were discussed at a private meeting of officers of the B.E.A. and Merioneth County Council at Dolgelly last Thursday. Among those present was Sir Patrick Abercrombie, consultant to the Snowdonia Park Advisory Committee. Mr D. W. Jones-Williams, clerk to Merioneth County Council, stated afterwards that the discussion would prove to be very helpful when the Council come to consider the scheme.

Leeds

The Lord Mayor of Leeds, Councillor H. S. Vick, the 112 members of the City Council, and some chief officers of the Corporation, have been invited by Mr G. A. Vowles, Yorkshire Divisional Controller, British Electricity Authority, to visit the Skelton Grange Power Station near Leeds on Oct. 7. This visit, which will last two hours, will be followed by an official dinner. The foundation stone of the power station was laid in October, 1948, by the late Alderman George Brett, then Lord Mayor. The station now has four 60 MW turbo-generators in operation, the first of which was placed in commission in April 1951. Ultimate capacity is to be 360 MW. An aerial view of the station, with other details, was published in our 5 July, 1951 issue.

Sheffield

Fire in a tip belonging to the B.E.A. on the hill behind Neepsend power station recently damaged some of the six 11 kV underground cables which were placed in the ground beneath it. The cables supplied the highly concentrated industrial load in the Upwell Street area, one feeding the English Steel Corporation's works. A few weeks ago equipment at Neepsend indicated that one of the cables had been damaged by the fire in the tip, and subsequently another cable broke down, it is reported. Tests indicated that all the cables were affected, the fault in each being under the burning tip. By a strenuous effort, officials of the No. 3 sub-area of the Yorkshire Electricity Board installed within a week a further six 11 kV cables which were laid in a 1,100 yd long trench circumventing the affected area.

Tiverton

Major engineering works designed and carried out by the staff of the South Western Electricity Board to reinforce the supply network in the Exe Valley district centred on Tiverton, were inspected by Mr S. F. Steward, C.B.E., chairman of the Board, last Thursday. In the past four years the demand for electricity in the district (which is almost wholly rural) has increased by over 40%, and 2,020 new consumers, including 225 farms and 1,625 houses and cottages, have been connected. Until recently electricity from the National Grid line at Taunton reached Tiverton by 33 kV lines to Tiverton Junction and Exebridge and then by secondary 11 kV feeders into Tiverton. To help meet the expanding needs of the district, the Board have now completed a £31,000 scheme to extend the 33 kV system into Tiverton itself. A 33 kV power line, 9,000 yards long, has been extended from Tiverton Junction and a new substation built at Moorhayes to step down the voltage and control the distribution of electricity supplies in the town and the surrounding rural area, bounded by the villages of Cove, Frogwell and Halberton. Mr H. T. Corrigan, the Board's Exe Valley District manager, stated that the project now completed was the first stage of a larger scheme to supply Tiverton, which would include the erection of a further 33 kV line from Loyton, near Morebath, to Tiverton and reinforcement of the 11 kV network in Tiverton itself. Plans are in hand for the further extension of electricity supplies on new housing estates, including Wilcombe Lane and Cowleymoor, where electricity will be needed for an additional 650 houses. Plans are also well in hand for widespread rural electrification, including the connection of over 200 premises at Exford and Withypool, which will be the largest single scheme yet undertaken in the South West.

LIGHTING SCHEMES

Briercliffe. The parish council has approved a scheme of electric street lighting from Haggate to Holt Hill.

Darlington. T.C. has received loan sanction for £4,326 for the provision of street lighting on the Branksome estate.

Newcastle-upon-Tyne. The city lighting committee has reported that the estimated cost of converting the remaining 10,079 gas street lamps to electricity would be £352,760. The Finance Committee has recommended that the scheme be spread over ten years.

COMPANY ACTIVITIES

FIRST public act of Mr Oliver Lyttelton, who resumed the chairmanship of Associated Electrical Industries after resigning his Cabinet post, is to raise the group's interim dividend to 4% on the £17,741,192 ordinary capital. It compares with 7½% paid last time on behalf of the present capital, so that the increase is equal to ½%. The difference is so small that it is quite impossible to read anything special into the payment, especially as the final of 6½% last time together with a 1½% bonus was paid on the present capital.

Sterling Industries Ltd., formally Ismay Industries Ltd., is encountering fresh difficulties, and the long awaited reconstruction scheme has been further delayed. In the year to 31 Mar. last, Mr T. W. Vernon, the chairman and managing director, reports a group trading loss of £71,564 as compared with a trading profit of £77,897 for the previous year. Arrears dividend on the £350,000 Preference capital totalled £274,312 gross at the year end. Ordinary shareholders last received a dividend of 6% in 1936-37. The chairman reports that reduction in the production of the group's main subsidiary (Dualloys Ltd.) continued for the whole of the year and it was only in June last that a revival commenced. Notwithstanding heavy fall in sales, it was decided that the majority of the trained force of labour and staff should be kept intact. Special circumstances, and this decision involved the Company in a loss which the directors have sound reasons for considering to be a temporary set-back only.

The past year was also unfortunate for Dueram Products Ltd., a subsidiary which specialises in powder metallurgy. The order position increased to an extent that made it essential early in 1953 to adopt an expansion programme designed to be complete by the end of that year. But delays in delivery from manufacturers of two main items in the new installation followed by faults which caused idleness for considerable periods necessitated a great deal of uneconomical working of the remaining plant. These setbacks, states Mr Vernon, have only just now been overcome. So in addition to last year's loss, there will be some adverse effects on results in the current year. Prospects for the future are regarded as being favourable.—*From our City Correspondent.*

Berry's Electric Ltd.

The trading profit for the year ended 31 Mar. last is £89,102, compared with £48,242 for the previous year. The dividend is raised by 2½% to 7½%. In the full accounts, stock and work-in-progress is valued at £156,784 against £197,247 a year earlier, but cash at bank and in hand has jumped from £423 to £78,848 at the end of March last.

British Industrial Plastics Ltd.

The directors state that the recovery in trade, reported in the chairman's statement with the annual report as having commenced in June 1953, has been maintained, resulting in an increase in group turnover for the first nine months of the current financial year of 40% above that of the same period a year ago.

Calcutta Tramways Ltd.

With the least delay, this company must be restored to a position when it will be possible once more to place sums to reserve, Mr D. E. Webb, the chairman, stated at last Thursday's meeting. Only by that means could the normal development of the system be maintained and only from that source could the necessary funds be provided for ensuring that the efficiency of the undertaking continued unimpaired and progressive. For that reason, he will be taking up the question of an increase in fares once more when he goes to Calcutta in November. The Government and tribunals in Calcutta at present contend that any capital expenditure incurred in improving the existing undertaking should be met by new capital raised outside the business. While that view would be sound if a major extension were contemplated, it was not practicable where it was simply a question of modernising rolling stock, replanning track layout, strengthening substations or re-equipping workshops, he added.

George Cohen Sons and Co. Ltd.

In his review of the operations of the associated companies, Mr C. M. Cohen, chairman and managing director, reports that at the New London Electron Works the new detinning process is being perfected and progressively introduced. This will show considerable reductions in operating costs. Additional new qualities and types of iron powders are being produced. As to the future outlook, the downward trend of orders at Letchworth has now been reversed, he states, and although margins have appreciably narrowed, and a consequent drop in profits from recent record levels is certain, he nevertheless expects K and L Steelfounders and Engineers Ltd. to do very well again.

Crystalate Ltd.

This plastic moulding concern also reports better trading conditions and improved results for the first four months of the current year. This information is given by Mr J. Lesser, the chairman, in his statement accompanying the accounts for the twelve months ended 31 Mar. last.

R. A. Lister and Co. Ltd.

The directors recommend that the capital be increased to £5 millions by the creation of 1,400,000 Ordinary shares of £1 each and that £1,040,000 from the share premium account and general reserve be capitalised and applied in paying up in full 1,040,000 shares of £1 to be allocated to stockholders in the proportion of two for every £5 of Ordinary stock held.

Palestine Electric Corporation Ltd.

For 1953, the net profit, after all charges, amounts to I.£562,323, compared with I.£36,344 for the previous year. The 1953 total is arrived at after providing I.£600,000 for taxation whereas the 1952 figure was after crediting a tax refund of I.£331,186 applicable to previous years. But in view of the terms of the recent offers of the Israel Government to purchase the Ordinary and "A" Ordinary stock, the directors have stated that they are not in a position to recommend any dividend for the year.

Ransome and Marles Bearing Co. Ltd.

The group profit for the year ended 30 June last is £1,016,894. For the previous year the corresponding total was £1,004,338. There is a final dividend of 7½% plus a bonus of 2½% on the increased capital.

Southern Brazil Electric Ltd.

For 1953 the total income amounted to £164,186, against £159,573 a year ago. After charging interest, Brazilian foreign residents' tax, etc., the balance remaining is £104,045 (*£125,386*). Undeclared Cumulative Preference dividends total £502,700.

Strand Electric Holdings Ltd.

The group profit for the year to 30 Apr. last is £50,740, compared with £39,228 a year ago. The dividend is again 17½%.

Stream-Line Filters Ltd.

The full accounts for the year ended 31 Dec. last show an increase in the value of stock and work in progress at that date, compared with the figure for a year previously. The respective totals are £74,398 and £59,656. Cash at bankers and in hand has also jumped by nearly £180,000, to the sum of £396,334.

Dividends Declared

International Combustion (Holdings) Ltd. Interim of 10% (5%).

Herbert Terry and Sons. Interim of 2½% (5%) on doubled capital.

A. H. Hunt (Capacitors). Interim of 7½% (*same*).

A. Reyrolle and Co. Interim of 6½% (*same*).

Associated Electrical Industries. Interim Ordinary dividend of 4% (7½%) on doubled capital.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

17 Sept.—Chigwell U.D.C. Repairs, etc., to installations in 180 houses at Chigwell, Loughton and Buckhurst Hill.—See 9 Sept. issue.

17 Sept.—Sheffield T.C. Installation in 132 dwellings on Greenhill-Bradway estate.—See 19 Aug. issue.

17 Sept.—Wolverhampton T.C. Mercury and tungsten street lighting, including columns, lanterns, auxiliary control gear and time switches.—Advertised in 26 Aug. issue.

17 Sept.—Wortley R.D.C. Class A street lights at Chapeltown, nr. Sheffield.—See 12 Aug. issue.

17 Sept.—Yiewsley and W. Drayton U.D.C. Steel columns with lanterns, lamps and control gear.—See 26 Aug. issue.

18 Sept.—Burton-on-Trent T.C. Equipment for three street lighting schemes.—Advertised in 19 Aug. issue.

18 Sept.—Dublin T.C. Supply fittings for public lighting dept.—See 9 Sept. issue.

18 Sept.—Pembrokeshire. Installation in fire station and headquarters.—See 9 Sept. issue.

18 Sept.—Wirral U.D.C. Steel columns with lanterns, etc., for street lighting at Irby.—See 26 Aug. issue.

20 Sept.—Barnes T.C. Sodium lanterns, lamps, control gear with concrete columns, for improvements to main road lighting.—See 9 Sept. issue.

20 Sept.—Brentford and Chiswick T.C. Wiring of 146 houses on Ealing Rd estate.—Advertised in 9 Sept. issue.

20 Sept.—Lancashire. Wireless equipment for ambulance service.—See 12 Aug. issue.

20 Sept.—Lancashire. Supply of electrical equipment.—Advertised in 9 Sept. issue.

20 Sept.—Rochdale T.C. Installations at Lea Hall youth club.—See 9 Sept. issue.

20 Sept.—Torquay T.C. Installation in 13 dwellings on Watcombe estate and 8 on Hele estate.—See 9 Sept. issue.

20 Sept.—Wigan T.C. Electrical work in housing schemes.—See 9 Sept. issue.

20 Sept.—Chippenham T.C. Supply of electrical fittings. Borough Engineer, 10 Market Place.

21 Sept.—Melford (Suff.) R.D.C. Wiring in 328 houses.—See 26 Aug. issue.

22 Sept.—Bacup T.C. Street lighting on Tunstead Rd estate.—See 9 Sept. issue.

22 Sept.—Peterhead T.C. Electricity services in site preparation at Clerkhill.—See 2 Sept. issue.

22 Sept.—Kingston-on-Hull T.C. Installation at Jervis secondary modern school for boys.—See 9 Sept. issue.

22 Sept.—Wembley T.C. Conversion of street lighting to sodium vapour discharge lighting.—Advertised in 9 Sept. issue.

23 Sept.—Co. Antrim. Installation in school at Larne.—See 2 Sept issue.

23 Sept.—Newark-on-Trent T.C. Group B street lighting in Bowbridge and Boundary Rds. Same for Sherwood Ave and Beacon Hill Rd.—Advertised in 2 Sept. issue.

24 Sept.—Belfast T.C. Equipment for fluorescent street lighting.—Advertised in 2 Sept. issue.

24 Sept.—Surbiton T.C. Supply and erection of 28 units comprising 250 W mercury vapour discharge lamps, 25 ft concrete columns, for improved lighting in Villiers Ave and Lamberts and King Charles Rds. R. Thirlway, Borough Engineer and Surveyor, Council Offices, Ewell Rd.

24 Sept.—Norwich T.C. Supply and installation of electrical switchgear, cables and accessories for Whitlingham sewage disposal works. H. C. Rowley, City Engineer, City Hall. Deposit £2. 2s.

25 Sept.—Reading T.C. Wiring in 103 houses on council's estates. Borough Architect, Town Hall.

25 Sept.—Frome U.D.C. Electrical installation at North Hill Hse. B. H. Parkes, surveyor, 22 Christchurch St West. Deposit £1. 1s.

25 Sept.—Failsworth U.D.C. Supply and erection of 13 group B lighting columns with 6 sodium discharge and 7 tungsten lamps for Pole Lane and Poplar St. Engineer and Surveyor, Town Hall. Deposit £1 1s.

27 Sept.—Co. Down. Electrical installation in 72 houses at Ballynahinch, N. Ireland Housing Trust, 12 Hope St, Belfast. Deposit 10s.

27 Sept.—Dartford T.C. Supply and erection of 82 complete lighting units—400 W mercury vapour lamps, concrete columns, etc.—along trunk road A.2 and Princes Rd North. T. Armstrong, town clerk. Deposit £2. 2s.

27 Sept.—Oswestry T.C. Electrical installation in 76 houses on Middleton Rd estate. J. E. Taylor, borough surveyor, Guildhall.

27 Sept.—Plympton (Dev.) R.D.C. Seven sets electrically driven sewage pumps.—See 19 Aug. issue.

30 Sept.—Colne T.C. Erection in Keighley Rd of 25 140 W sodium discharge lamps with 25 ft concrete columns. Borough Engineer, Town Hall.

30 Sept.—Durham. Electrical equipment for Walworth Castle residential school. L. W. Davis, dep. director of education, Shire Hall.

30 Sept.—Thetford T.C. Concrete columns to group "A" with lamps, lanterns and auxiliary equipment along A 11.—Advertised in 26 Aug. issue.

30 Sept.—Manchester T.C. Supplies required in year from 1 Jan. include concrete and steel columns, mantles, lanterns, conversion boxes and cable for street lighting, bollard batteries, glass globes, road danger lamps, time switches and torch lamps. County Surveyor, Room 329, Town Hall.

30 Sept.—Dublin T.C. Supply of 6,000 yd of underground cable for public lighting dept. Finance Dept., City Hall.

1 Oct.—Dublin T.C. Installation at 25 and 26 Upper Merrion St. J. Tyrrell, secretary, Office of Public Works, Dublin. Deposit £1.

1 Oct.—Sheffield T.C. Electrical installations in 88 dwellings on Greenhill-Bradway estate. Names by 17 Sept. to J. L. Womersley, City Architect, Town Hall. Deposit £2.

1 Oct.—Middleton T.C. Installation in 80 houses on Hollin estate.—See 9 Sept. issue.

2 Oct.—Inverness. Electrical installation in 22 houses in Beauly housing scheme. Apply to James Shankley, quantity surveyor, 2 Ness Walk.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources including an index of trade information with over 100,000 entries

A Selection from the 115 queries answered this week

"Interdial" telephone apparatus, makers of? B.E.—E. Shipton and Co., Ltd., Ferndown Works, Pinner.

"Camley" refrigerators, makers of? B.R.—The firm was the Camley Engineering Co., Ltd., of Leeds, but that concern went into liquidation last year.

"Rathbone" dental equipment, makers of? E.E.B.—Dental Manufacturing Co., Ltd., Brock Hse, Gt. Portland St, W.1.

Butter making machines, makers of? I.G.R.C.—J. J. Blow Ltd., Oldfield Works, Chesterfield; Churn Co., Station Rd, Hailsham, Sussex; Alvan Blanch Development Co., Ltd., Chelworth, nr. Malmesbury.

"Penberthy" pumps, agents for? L.D.W.—W. H. Willcox and Co., Ltd., 49 Southwark St, S.E.1.

"Moorlite" fluorescent fittings, makers of? B. and C.—E. J. Schofield and Co., Ltd., 17 Back Bridge St, Manchester.

"Readson" h.f. apparatus, makers of? P.E.H.—F. W. Read and Sons Ltd., 175 Grays Inn Rd, W.C.1.

ANSWER WANTED.

"Addison" irons, makers of? S.E.

2 Oct.—Middleton T.C. Supply of 68 60 W sodium vapour lighting units with concrete columns, and 290 100 W tungsten units with concrete columns for group B street lighting on Langley Neighbourhood Unit Development. Borough Engineer and Surveyor, Town Hall.

4 Oct.—Burnley T.C. Supply and erection of pumping and electrical equipment for proposed water booster station. Water Engineer, Yorkshire St.

9 Oct.—Inverness. Electrical installation in 24 houses at Kiltarlity. Apply to James Shankley, quantity surveyor, 2 Ness Walk.

11 Oct.—Lurgan (N.I.) T.C. Lighting and power installation at Castor's Bay waterworks.—See 9 Sept. issue.

12 Oct.—Grantham T.C. Supply and erection of 668 concrete columns and wall brackets with lanterns and control gear. Borough Engineer and Surveyor, Guildhall. Deposit £2. 2s.—Advertised in this issue.

14 Oct.—Grimsby T.C. Installation in new police H.Q. in Victoria St.—See 9 Sept. issue.

15 Oct.—Strabane (N.I.). Wiring of Strabane Presbyterian church.—See 9 Sept. issue.

29 Oct.—Oswaldwistle U.D.C. Electrical installation in 32 dwellings on White Ash estate. T. D. Manning, Engineer and Surveyor, Town Hall. Deposit £1. 1s.

No date stated.—Wigtown. Installation in 84 houses at Kirkcowan and Dunragit.—See 9 Sept. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon House, Theobalds Rd, W.C.1, quoting reference.*

1 Oct.—South Africa. Electricity Dept., City of Durban, require supply of four five-panel, pedestal type, metal-clad, air-insulated, single busbar, three-phase switchboards of draw-out type. Contract E2513. B.o.T. (Ref.: ESB 21554/54).*

2 Oct.—Iraq. Supply and erection of a self-contained diesel engine driven generating plant of 1,000 kW capacity, etc., for Mosul Electricity and Water Board. Documents from Board's Accountant at 1 dinar. B.o.T. (Ref.: ESB 21555/54).*

5 Oct.—Uruguay. Administracian General de las Usinas Electricas y los Telefonos del Estado requires supply of 25,000 dry batteries of 1·5 V for microphonic feeding of battery subscribers. (Tender No. 2319). B.o.T. (Ref.: 20699/54).*

7 Oct.—Australia. Supply of six 11,000 V automatic outdoor type switchgear units, 50 c/s, 3-phase, for Southern Electric Authority of Queensland, Boundary St, Brisbane. Contract no. 54/14. B.o.T. (Ref.: ESB 20793/54).*

8 Oct.—New Zealand. Auckland Power Board requires 50,000 yd of 0·075 sq in. weatherproof braided aerial cable to be used for 400 V a.c. overhead lines. Deposit £75. B.o.T. (Ref.: ESB 21176/54).*

11 Oct.—Brazil. Supply and installation of underground cables for State Electricity Commission, Porto Alegre, Rio Grande do Sul. Apply to the Turma de Comunicocoes e Arquivos. Comissao Estadual de Energia Eletrica, Edificio Nova de Prefeitura, 11. andar, Porto Alegre, Rio Grande do Sul, Brazil. B.o.T. (Ref.: ESB 2143/54).*

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, 14 September

	£ per ton	Weekly change £	Price last year £
COPPER, standard class A (settlement)	248	+2	229
,, (3 months)	240	+$\frac{3}{4}$	213$\frac{1}{2}$
LEAD, refined pig, min. 99·97% purity (cash)	102	+1$\frac{1}{4}$	90$\frac{1}{2}$
,, (3 months)	100	+$\frac{1}{2}$	86$\frac{3}{4}$
TIN, refined, min. 99·75% purity (settlement)	740	+6	598$\frac{1}{2}$
,, (3 months)	738	+4	591$\frac{1}{2}$
ALUMINIUM, ingots 99-99·5%	150	—	150
ZINC, virgin, min. 98% purity (cash)	81$\frac{3}{4}$	+$\frac{3}{4}$	67$\frac{3}{4}$
,, (3 months)	81$\frac{1}{2}$	+$\frac{1}{2}$	67$\frac{1}{2}$
RUBBER No. 1, RSS. spot (per lb.)	21d.	+$\frac{1}{8}$d.	19$\frac{1}{2}$d.
,, c.i.f. basis, ports. Oct. (per lb.)	20$\frac{1}{2}$d.	+$\frac{1}{8}$d.	19$\frac{1}{2}$d.
ARMOURING:			
Galv. Steel Wire (0·104 in.)	52$\frac{1}{2}$	+$\frac{1}{2}$	50$\frac{1}{2}$
Mild Steel Tape (0·014 in.)	40$\frac{1}{2}$	—	40

11 Oct.—India. Supply of h.t. and h.t. and l.t. cables and accessories. Documents from Chief Engineer, Bombay Port Trust, Ballard Rd, Fort, Bombay, at Rs. 15.

14 Oct.—New Zealand. Tenders (P. and T. 150/7213) invited for supply of various electric lamps, and associated fittings by Post and Telegraph Dept., Wellington. B.o.T. (Ref.: ESB 21122/54).*

14 Oct.—Uruguay. Administracion General de las Usinas Electricas y los Telefono del Estado, requires 1,200 metres of submarine cable and accessories. Specification No. 4085/54. B.o.T. (Ref.: ESB 21625/54).*

19 Oct.—Pakistan. Dept. of Supply and Development, Frere Rd, Karachi, requires supply of quantities of isolators, circuit-breakers and transformers. B.o.T. (Ref.: ESB 21717/54).*

20 Oct.—Uruguay. Supply of total of 1,300 mts armoured cables and accessories for Administration General de las Usinas Electricas y los Telefonos del Estado, Montevideo. Specification No. 4089/54. B.o.T. (Ref.: ESB 21626/54).*

26 Oct.—Burma. Supply of 116 transformers for rural electrification scheme required by Electricity Supply Board, Union of Burma, 153 Ahlone Strand Rd, Rangoon. B.o.T. (Ref.: ESB 21862/54).*

29 Oct.—India. Supply of 30,000 kW steam generating plant. Tender No. Project/SE-2/2101-E/I. Director General of Supplies and Disposals, Shahjahan Rd, New Delhi. Documents at Rs. 160. B.o.T. (Ref.: ESB 21298/54).*

25 Nov.—India. Tenders (SE 2/2129.E/111) invited for supply of oil circuit-breakers, automatic reclosure, bank of capacitor and isolator switches. Director General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (Ref.: ESB, 21396/54).*

26 Nov.—India. Tenders (No. SE2/2127-E/111) invited for supply of 130 oil circuit-breakers under Tech. Cooperation Administration Programme. Documents from Director General of Supplies and Disposals, Shahjahan Rd, New Delhi, at Rs. 6. B.o.T. (Ref.: ESB 21436/54).*

14 Dec.—Australia. Supply, erection, etc., of seven 56 MVA single-phase transformers and ancillary equipment for Snowy Mountains H.E. Authority. Contract No. 40006. Documents at £1 a set from various addresses, including Stores and Supply Branch, Head Office, Cooma, N.S.W.

Gazette Announcements

COMPANIES ACTS

Radio, Electrical and General Exporters Ltd. Last day for receiving proofs in respect of intended dividends, 22 Sept. Liquidator is J. M. Clarke, Sr. Official Receiver, Inveresk Hse, 346 Strand, W.C.2.

Winding-Up

Etherington and Partners Ltd. Official Receiver has stated that within nine months of company's incorporation it was insolvent to extent of £2,480. Statement of affairs shows estimated deficiency to creditors of £5,586. Unsecured liabilities are returned at £7,783, of which £5,147 was due to trade creditors; £2,356 loans; £203 expenses; and £77 bank overdraft. Net assets valued at £2,197. Official Receiver reports that company was formed in March, 1950, under style of Brooks and Bohm (Electrical) Ltd. Nominal capital was £3,000, of which £1,000 has been issued.

BANKRUPTCY ACTS

Intended Dividends

Gt. Grimsby. Ernest S. Mellor, electrical engineer trading at 15 Cole St, Scunthorpe. Last day for receiving proofs, 25 Sept. Trustee is H. S. Bloomer, Official Receiver, 8 Flottergate, Grimsby.

Hereford. Philip Thomas, radio and electrical engineer, trading at 4 New St, Ledbury. Last day for receiving proofs, 25 Sept. Trustee is R. K. Clark, Official Receiver, 37 Temple St, Birmingham.

Dividends

Portsmouth. Thomas R. Hugo, trading as Victor Hugo's at 51 Fawcett Rd, Southsea, radio and electrical engineer. First dividends of 6s. 8d. in £ payable on 25 Sept. at Official Receiver's Office, 16 Westwood Rd, Southampton.

Contracts Placed

Belfast. Street lighting equipment for Harbour Commissioners, Metropolitan Vickers Electrical Co., Ltd., £3,903.

Cardiff T.C. Underground cables for Ely trolleybus extension scheme, Aberdare Cables Ltd., £6,669.

Glasgow T.C. Installation of telephone exchange at 20 Trongate, Standard Telephones and Cables Ltd., £5,825.

Hastings T.C. Switchgear for pumps at Rother pumping station, Igranic Electric Co., Ltd., £3,539.

Southall T.C. Street lighting columns, gear and lanterns, and wiring in Uxbridge Rd, Eleco Ltd, £8,116.

BUSINESS PROSPECTS

Home

Alcester (War) R.D.C. Construction of 30 houses at Bidford-on-Avon, and 4 at Wixford. Surveyor, Council Offices.

Bridlington T.C. Construction of factory on industrial estate. Borough Engineer, Town Hall.

Brighton T.C. Erection of 48 flats on Hollingbury estate. Borough Engineer and Surveyor, 26-30 King's Rd.

Bristol. New offices to cost about £90,000 proposed by Carsons Ltd. at Mangotsfield. Architects are A. MacDonald and Partners, 1 Unity St.

Bromsgrove U.D.C. Erection of total of 34 houses and 30 flats on Broad St estate. Engineer and Surveyor, Council Hse.

Essex. Tenders being invited for preliminary work in erection of Dovercourt Hill secondary school. County Architect is H. Conolly, County Hall, Chelmsford.

Gosport. Camper and Nicholson Ltd. are planning to build offices and workshops in Clarence St. Consulting engineer is H. I. Hughes, 66 Victoria St, London, S.W.1. Cost estimated at £70,000.

Harold Hill (Essex). Architects for £80,000 factory planned by Sklan Ltd. are Chamberlain and Willows, 23 Moorgate, E.C.2.

TRADE NOTES

Change of Address. Pyrotenax Ltd, announce that their Midlands office has moved to new premises at Martins Bank Chambers, 140/141 Broad Street, Birmingham 15. Telephone number, Midland 1265. The new offices will have a fully equipped demonstration and instruction department.

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Llangefni. Welsh Agriculture and Industries Ltd to build new factory at Pencraig. Plans by T. Alwyn Lloyd and Gordon, 6 Cathedral Rd, Cardiff.

London. Architects for erection of office blocks in Finsbury Sq. are Lewis, Solomon, Son, and Joseph, 21 Bloomsbury Sq, W.C.1, and Mewes and Davis, 1 Old Burlington St, W.1. Multi-storey office building to be built in Mincing Lane. Howard, Souster and Fairbairn, 81 Piccadilly, W.1, are architects.

Middlesex. Preliminary planning approval given to construction of two hotels near London Airport. Both will be in Bath Rd, Harlington; one at junction of High St and the other at junction of New Rd. Applicants are C. W. Glover and Partners, architects and consulting engineers, 54 Victoria St, S.W.1, and International Air Travel Hotel Inc., resp. Architect for latter is A. S. Ash, 66 Gt. Cumberland Place, W.1.

Norman Cross (Hunts) R.D.C. Erection of 54 houses on Broadway estate, Yaxley. Ruddle and Wilkinson, architects, Long Causeway Chambers, Peterborough.

Ormston (Lancs). Plans approved for 2-storey extension in Trafford Park Rd. for Carborundum Co., Ltd., and building in Tenax Rd for Ashburton Chemical Co., Ltd.

Penistone U.D.C. Construction of 16 dwellings on new site in Manchester Rd. Architects, Turner and Holland, 4 King St, Wakefield.

Penrith U.D.C. Erection of 36 houses near Folly Lne. Surveyor, F. Birkbeck, Town Hall.

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Stockton-on-Tees. Improvements to be carried out on lighting installation at Mill Lane (£175) and Bowesfield Lane (£480) county girls' schools.

Sunderland. James Deuchar Ltd, Eldon Sq, Newcastle-on-Tyne, are to rebuild their war damaged Empress Hotel in Union St. Architect is Edwin M. Lawson, Barras Bldg, Barras Bridge, Newcastle. Work may not start for some time.

Overseas

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Representation of U.K. manufacturers of high fidelity equipment, particularly speakers and amplifiers, is subject of enquiry of Mr R. B. Ritter, of Ritter Sales Co., 612 N. Michigan Ave, Chicago 11, Illinois.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, W.C.2.

D. Woolfman Ltd. Manufacturers of and dealers in electrical and mechanical apparatus and accessories, in particular wireless sets, television sets, etc. Nom. cap.: £1,000. Dirs.: D. Woolfman, 76 Ilford Lane, Ilford, Essex, and J. R. Woolfman, 81 Westrow Drive, Barking, Essex.

Hudson Evans (Birmingham) Ltd., 10 Frankfort St, Birmingham, 19. Engineers and machinists, pressworkers, manufacturers and factors of engineering and electrical parts and accessories, etc. Nom. cap.: £1,000. Dirs.: H. J. Evans and J. E. Hudson.

Hiscock, Appleby and Co. Ltd., 2 Cadogan Place, Sloane St, S.W.1. Electrical engineers and contractors, etc. Nom. cap.: £10,000. Dirs.: R. C. Hiscock and Nancy B. Hiscock.

J. Wilson and Co. (T.V.) Ltd. 191 Tynemouth Rd, North Shields. To take over business of television, radio and electronic engineers carried on as "J. Wilson and Co." at North Shields. Nom. cap.: £3,000. Dirs.: J. Wilson, R. N. Dodds and T. Dodds.

Millmans of Kensington Ltd. 202B Kensington High St, W.8. Manufacturers of and dealers in refrigerators, heating and cold storage machinery, plant and accessories; gramophones, wireless sets, etc. Nom. cap.: £100. Dirs.: S. Shirman and B. Shirman.

Minchom Magnetic Systems Ltd. Electrical and mechanical engineers, etc. Nom. cap.: £100. Dirs.: R. I. Minchom and Jenny L. Minchom, 15 Cheyne Walk, Hendon, N.W.4.

B.O.B. (Northern) Ltd. Old Colony Hse, South King St, Manchester, 2. Heating and ventilating engineers, plumbers, boiler makers, etc. Nom. cap.: £1,000. Dirs.: J. R. C. Boyce and G. F. Ward.

Mayfair Good Housekeeping Supplies Ltd. 16 Manchester Sq, W.1. Manufacturers of and dealers in household, industrial, and electrical appliances, etc. Nom. cap.: £500. Dirs.: K. J. Mitchell and Mrs T. O. Mitchell.

MEETINGS TO NOTE

THURSDAY, 16 SEPT.

INCORP. PLANT ENGRS. (Blackburn). "Management." Golden Lion Hotel, 7.30 p.m.

INCORP. PLANT ENGRS. (Merseyside). "Repair of Cracked Castings." N. Tinwell. Chester.

A.S.E.E. (Watford). "Power Factor Correction." F. T. Bartho. Clarendon Hotel, Station Rd, 8 p.m.

A.S.E.E. (Kent). "Cathode-ray Picture Tubes." H. J. Beach. Sun Hotel, Chatham. 8 p.m.

MONDAY, 20 SEPT.

SCOTTISH RADIO SHOW at St. Andrew's Hall, Glasgow. Closes on 25 Sept.

NAT. DISPLAY CONVENTION AND EXHIBN. at Old and New Horticultural Society's Halls.

IPSWICH ELECTRICAL ASSOC. Chairman's address by H. E. Wright. Electric Hse, Lloyds Ave, 7.30 p.m.

TUESDAY, 21 SEPT.

COVENTRY ELECTRIC CLUB. "Electric Space Heating and Thermal Storage." J. L. Rycroft, Elect. Sports and Social Club, Merrick Lodge, St. Nicholas St.

WEDNESDAY, 22 SEPT.

E.I.B.A. Annual meeting, at I.E.E. headquarters, Savoy Place, W.C.2, 11 a.m.

THURSDAY, 23 SEPT.

WOMEN'S ENGRNG. SOC. "Current Aspects of TV." R. W. Addie, 35, Grosvenor Place, S.W.1, 7 p.m.

FRIDAY, 24 SEPT.

INCORP. PLANT ENGRS. (Birmingham). "Materials Handling in Saw Mills and its Problems." H. B. Marson. Imperial Hotel, 7.30 p.m.

INTERNATIONAL COMM. MOTOR TRANSPORT EXHIBN. at Earls Court, London. Continues until 2 Oct.

E.W.F. Dance in aid of E.I.B.A. at Londonderry Hse, Park Lane, W.1.

Cartridge Fuse-links

PLEASE WRITE FOR CATALOGUE 30

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD., 51-53 HATTON GARDEN, LONDON, E.C.1

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INCORP. PLANT ENGRS. (Blackburn). "Management." Golden Lion Hotel, 7.30 p.m.

INCORP. PLANT ENGRS. (Merseyside). "Repair of Cracked Castings." N. Tinwell. Chester.

A.S.E.E. (Watford). "Power Factor Correction." F. T. Bartho. Clarendon Hotel, Station Rd, 8 p.m.

A.S.E.E. (Kent). "Cathode-ray Picture Tubes." H. J. Beach. Sun Hotel, Chatham. 8 p.m.

MONDAY, 20 SEPT.

SCOTTISH RADIO SHOW at St. Andrew's Hall, Glasgow. Closes on 25 Sept.

NAT. DISPLAY CONVENTION AND EXHIBN. at Old and New Horticultural Society's Halls.

IPSWICH ELECTRICAL ASSOC. Chairman's address by H. E. Wright. Electric Hse, Lloyds Ave, 7.30 p.m.

TUESDAY, 21 SEPT.

COVENTRY ELECTRIC CLUB. "Electric Space Heating and Thermal Storage." J. L. Rycroft, Elect. Sports and Social Club, Merrick Lodge, St. Nicholas St.

WEDNESDAY, 22 SEPT.

E.I.B.A. Annual meeting, at I.E.E. headquarters, Savoy Place, W.C.2, 11 a.m.

THURSDAY, 23 SEPT.

WOMEN'S ENGRNG. SOC. "Current Aspects of TV." R. W. Addie, 35, Grosvenor Place, S.W.1, 7 p.m.

FRIDAY, 24 SEPT.

INCORP. PLANT ENGRS. (Birmingham). "Materials Handling in Saw Mills and its Problems." H. B. Marson. Imperial Hotel, 7.30 p.m.

INTERNATIONAL COMM. MOTOR TRANSPORT EXHIBN. at Earls Court, London. Continues until 2 Oct.

E.W.F. Dance in aid of E.I.B.A. at Londonderry Hse, Park Lane, W.1.

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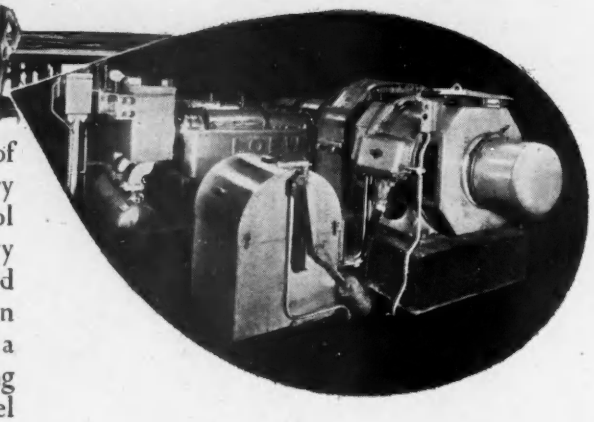

For maximum reliability and ease of maintenance, leading plant and machinery manufacturers choose motors and control gear by Metrovick. This 2,700 ton Loewy hydraulic press, for example, is powered from an air hydraulic accumulator station with five pumps each driven by a Metrovick 550 hp type RW slipring motor. The type R series of squirrel cage and slipring motors extends from 35 to 3,000 hp. Various types of enclosures are available including screen protected, drip-proof, totally enclosed with pipe ventilation, or totally enclosed with fan cooling. Write for descriptive literature dealing with your particular interest.

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J/A 301

CLASSIFIED ADVERTISEMENTS

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 32s. 6d. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

TENDERS INVITED

BOROUGH OF GRANTHAM
ELECTRIC STREET LIGHTING

TENDERS are invited for the supply and erection of 668 concrete lighting columns and wall brackets together with lanterns and control gear.

Specification and bills of quantities may be obtained from the Borough Engineer and Surveyor, Guildhall, Grantham, on payment of a deposit of £2. 2s., which will be returned on receipt of a bona fide tender.

Tenders, in plain sealed envelopes endorsed "Tender for Street Lighting," should reach the undersigned not later than 10 a.m. on Tuesday, 12 Oct., 1954.

JOHN F. GUILE,
Guildhall, Town Clerk.
Grantham. (N 129)

APPOINTMENTS VACANT

Engagement of persons must be made through a Local Labour Office or Scheduled Employment Agency, if the applicant is a man aged 18-64, or a woman aged 18-59; unless the person concerned is excepted or the employment is in a managerial or professional capacity, or is otherwise excepted from the provisions of the Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY
South Eastern Division

MAIDSTONE Power Station—STATION SHIFT CONTROL ENGINEER. Applicants should have had a sound technical education and experience in the operation of turbo-generators and Control Room duties. Class C, Grade 10, £502 p.a.

Applications giving details of education, present position, experience, etc., should be sent to the Station Superintendent Maidstone Power Station, Fairmeadow, Maidstone, Kent, not later than 25 Sept. (N 150)

INSTRUCTOR IN GENERAL ELECTRICAL ENGINEERING

required by the MOMBASA INSTITUTE of MUSLIM EDUCATION, KENYA, for one tour of 3 years in the first instance with prospect of further employment by mutual agreement. Salary scale (including present temporary allowance of £165/£300 a year) £715 rising to £1,325 a year. Commencing salary according to age, qualifications and experience. Outfit allowance £30. Contributory superannuation scheme. Free passages and free furnished quarters. Liberal leave on full salary. Candidates between 23 and 35 years should have served an appropriate apprenticeship and have wide subsequent practical experience including Outside Wireman's work. They must be capable of instructing in all forms of general electrical engineering both in theory and in practice, and should hold a C. and G. Certificate or equivalent qualification. Write to the Crown Agents, 4 Millbank, London. S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/30683/EE. (N 156)

BRITISH ELECTRICITY AUTHORITY
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or D. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

SHIFT CHARGE ENGINEER—HACKNEY GENERATING STATION

Vacancy No. 54/772

Sound practical and technical training in Electrical and Mechanical Engineering with practical experience in operation of Power Station plant. Experience of pulverised fuel an advantage. Salary—Class F, Grade 7= £731. 17s. p.a.

ASSISTANT SHIFT CHARGE ENGINEER WEST HAM GENERATING STATION

Vacancy No. 54/773

Sound practical and technical training in Electrical and Mechanical Engineering with practical experience in operation of Power Station plant. Salary—Class H, Grade 9= £714 p.a.

SENIOR DRAUGHTSMEN—ELECTRICAL ENGINEERING DIVISIONAL HEADQUARTERS

Vacancy No. 54/774

With experience in the preparation of engineering drawings associated with the design, layout and construction of the electrical plant in a modern Generating Station, including the following—H.T. and Auxiliary Switchgear, Generator Transformers, Motors and Starters, associated diagrams, cable schedules, etc. Salary—Grade 5= £595. 7s./£704. 11s. p.a.

ENGINEERING DRAUGHTSMEN—ELECTRICAL ENGINEERING DIVISIONAL HEADQUARTERS

Vacancy No. 54/775

With experience in the preparation of drawings associated with the layout and construction of modern Generating Stations. To be able to prepare under supervision final or working drawings. Salary—Grade 6 =£458/£595. 7s. p.a.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box No. 136, Generation House, Great Portland St, W.1, and be received within 14 days of this advertisement. (N 143)

BRITISH ELECTRICITY AUTHORITY
North Eastern Division

APPLICATIONS are invited for the appointment of STATION CHEMIST at Darlington Power Station.

Applicants should have had experience in modern Power Station Laboratories covering the analysis of fuel, water and oil and be conversant with water treatment and fuel sampling, and should possess at least a Higher National Certificate in Chemistry.

The salary for this appointment (which is superannuable) will be in accordance with the National Joint Board Agreement, Schedule "A," Grade 7, Class F (£697/£718 per annum).

Forms of application may be obtained from the Divisional Establishments Officer, British Electricity Authority, North Eastern Division, Carliol House, Newcastle upon Tyne, to whom they should be returned to arrive not later than 28 Sept., 1954. (N 134)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for a GENERAL ASSISTANT ENGINEER on Distribution work in North Caledonia Area. Salary £466/£548, N.J.B. Class F, Grade 13/11, according to qualifications and experience. Superannuation Scheme applicable. Applications stating age, qualifications and experience to be forwarded to Area Manager, West Villa, Elgin, Morayshire, by 27 Sept., 1954. (N 136)

CITY COUNCIL OF SINGAPORE
Electricity Department

APPLICATIONS are invited for the post of CONSTRUCTION ENGINEER in the City Electricity Department on 3 years' agreement in the first instance. On satisfactory completion of the agreement the appointee would normally be offered emplacement on the permanent establishment.

Applicants must be Graduate members of the Institute of Electrical Engineers or of the Institution of Civil Engineers, or equivalent. They must have experience in Design, planning and construction of Indoor and Outdoor High Voltage Substations involving specification of buildings and structural steelwork, etc. Minimum age 28 years.

The salary offered is $870, $910 and $950 a month for the first, second and third year respectively in the salary scale $870 x A40—990. Expatriation and Cost of Living Allowances are also payable.

If placed on the permanent establishment after satisfactory completion of the Agreement the basic salary will be $990 per month in the scale $870 rising to $990 per month (£1,218/£1,386 per annum).

Expatriation Allowance payable is £315 per annum on basic salary of $870 a month and £343 per annum on basic salary between $871 and $990 a month.

Cost of Living Allowance payable at present is £238 per annum on basic salary between $870 and $910 a month and £224 per annum on basic salary between $950 and $990 a month for a single man; £385 per annum on basic salary between $870 and $900 a month for a married man; £560 per annum on basic salary between $870 and $990 a month for a married man with one or more children. A dependent child means an unmarried child, including a stepchild or a legally adopted child, under the age of 17, or receiving full-time educational instruction and below the age of 21.

For a single man the minimum total emoluments on a basic salary of $870 a month would amount to £1,771 per annum: for a married man with no children £1,918 per annum; and for a married man with one or more children £2,093 per annum.

The exchange rate is approximately $1 to 2s. 4d. sterling.

Partly furnished quarters provided if available at 6% of basic salary or Housing Allowance of 10% of basic salary (subject to a maximum of $120 per month) paid in lieu.

Free passages will be provided for appointee, his wife and his own children under the age of 12 years at the date of sailing subject to a maximum of three full passages.

One month leave per year of service may be granted on satisfactory completion of agreement at the discretion of the Council. If placed on the permanent establishment on completion of the agreement the appointee will be required to serve a further year before proceeding on leave. The present rate of leave is 4 days per month of resident service. Local leave of 14 days a year cumulative to a maximum of 28 days is also granted.

Compulsory Provident Fund contributions at present 7½% of salary (but not allowances) to which the Council donate 7½% rising to 10% after 10 years' service, 15% after 15 years' service, and 20% after 20 years' service. This scheme is under review.

Further details from the Council's London Agents: Messrs Allen and Williams, 1 Victoria St. Westminster, London, S.W.1. Closing date for full applications, in Duplicate, Thursday, 14 Oct., 1954. (N 118)

EASTERN ELECTRICITY BOARD
Fens Sub Area

140/54.R
2ND ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)

CANDIDATES should have had a wide experience in the design, layout and operation of urban and rural distribution systems comprising overhead and underground networks (including substations) at voltages up to and including 33 kV. They should be experienced in the preparation of distribution schemes including the technical design, specification and estimates. Corporate membership of the Institution of Electrical Engineers or the possession of a degree in electrical engineering will be an advantage.

Salary will be in accordance with Class H, Grade 6 of the National Joint Board Salary Agreement commencing at £833 and future salary and conditions of service will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the Manager, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, within fourteen days of the appearance of this advertisement. (N 148)

BRITISH ELECTRICITY AUTHORITY
Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Electrical) is required at Walsall Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade H8, commencing at £717 per annum.

A sound technical training and experience in power station electrical maintenance required, and preferably the possession of appropriate qualifications.

Apply, quoting Vacancy No. 759MD on form AE6, available from the establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 2 Oct., 1954. (N 154)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments, which are superannuable and subject to medical examination:

ASSISTANT SECTION ENGINEER required in the Runcorn District of the Board's No. 2 Sub-Area. Salary £587/£600 per annum (N.J.B. Class E, Grade 9). Applicants should have had experience in H.T. and L.T. overhead and underground distribution work, and preferably have the technical qualifications to enable them to become Chartered Electrical Engineers.

FIRST ASSISTANT DISTRICT COMMERCIAL OFFICER required in the Northwich District of No. 2 Sub-Area. Salary £740/£774 per annum (N.J.B. Class E, Grade 5). Applicants should have had experience on the commercial side of the Electricity Supply Industry, including the control of contracting work. Preference will be given to applicants who are qualified to become Corporate Members of the Institution of Electrical Engineers.

Application forms for both the above posts are obtainable from the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire.

GENERAL ASSISTANT ENGINEER (Planning and Development) required at the Board's No. 3 Sub-Area Headquarters in Chester. Salary £552/£573 per annum (N.J.B. Class J, Grade 13). Applicants should have had experience with the design of H.V. and M.V. distribution networks and associated equipment. They should preferably possess the Higher National Certificate in Electrical Engineering, or its equivalent.

Application forms obtainable by written request from the Manager, No. 3 Sub-Area, Electricity House, Newgate St, Chester.

Closing date: 27 Sept., 1954. (N 119)

PROFESSIONAL ENGINEERS IN VARIOUS GOVERNMENT DEPARTMENTS

THE Civil Service Commissioners invite applications for pensionable posts in a wide variety of mechanical and electrical engineering duties. Provisionally the latest date for applications is 31 Dec., 1954, but an earlier date may be announced and early application is advised.

Candidates must be under 35 on 1 Jan., 1954, with extension for regular service in H.M. Forces and up to two years for permanent civil service. For the Post Office they must be at least 21, for the Ministry of Supply and Ministry of Transport and Civil Aviation at least 23, and for all other Departments at least 25 on that date.

Generally a candidate must possess a University degree in Engineering or be a Corporate Member of one of the professional institutions—Mechanical Engineers, Electrical Engineers, or Civil Engineers or have passes in, or exemption from, Sections A or I and B or II of the corresponding Associate Membership examinations. Exceptionally candidates of high professional attainment, but without the specified qualifications, may be admitted. For some posts Associate Fellowship of the Royal Aeronautical Society or an Honours degree in Physics or Engineering will be accepted.

London salary scale (men) £650 (at age 25) to £1,000. Starting salary according to age up to £900 at 34. Candidates entering below age 25 will start at salaries varying from £450 at age 21 to £570 at age 24. Prospects of promotion. Salaries of next higher grades are £1,000/£1,320 and £1,375/£1,575. Somewhat lower for women and in the provinces.

Further particulars and application forms from Civil Service Commission, Scientific Branch, 30 Old Burlington St, London, W.1, quoting No. S85/54. (N 142)

BRITISH ELECTRICITY AUTHORITY
East Midlands Division

ASSISTANT MAINTENANCE ENGINEER (ELECTRICAL) COVENTRY POWER STATION
Vacancy No. 141/54/ET

APPLICANTS should have received a thorough technical and practical training with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who are associated members of a recognised Institution or possess similar qualifications.

Salary will be in accordance with Class G, Grade 8 (£678/£704 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 28 Sept., 1954.

ASSISTANT SHIFT CHARGE ENGINEER NORTHAMPTON POWER STATION
Vacancy No. 142/54/ET

Applicants should have had a sound technical training and be experienced in the operation of modern steam power stations. They should preferably hold a Higher National Certificate in Electrical or Mechanical Engineering.

The salary for the appointment will be in accordance with Class G, Grade 9 (£641/£667 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 28 Sept., 1954.

SHIFT CONTROL ENGINEER AVON POWER STATION, WARWICK
Vacancy No. 144/54/ET

Applicants should have had some experience in Power Station Control and have O.N.C. in Electricity.

Salary will be in accordance with Class E, Grade 10 (£555/£569 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Oct., 1954.

SENIOR DRAUGHTSMAN (CIVIL) CONSTRUCTION DEPARTMENT
Vacancy No. 112/54/ET

Candidates should have experience in the preparation of detail drawings and in the design of one or more of the following subjects:

Reinforced Concrete structures.
Piled and slab foundations for heavy components.
Cable subways, Bridges and Culverts,

continued in next column

continued from previous column

The salary will be in accordance with Grade 4 (£671/£780 per annum) or Grade 5 (£567/£671 per annum) of Schedule D of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Oct., 1954.

ASSISTANT SHIFT CHARGE ENGINEER FREEMEN'S MEADOW POWER STATION, LEICESTER
Vacancy No. 143/54/ET

Applicants should have experience in the operation of a large pulverised fuel fired Station. The principal duties will be in the Boiler House. Technical qualifications up to H.N.C. are desirable.

The salary will be in accordance with Class H, Grade 9 (£680/£706 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 5 Oct., 1954.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number.

L. F. JEFFREY,
Divisional Controller.

10/9/54. (N 152)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER (PLANNING)

ALDERSHOT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 9 (£607 per annum). N.J.B. Conditions of Service.

The duties of the post will be to assist the Planning Engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground HV and LV networks, and will be required to undertake standby duties if required. The possession of suitable technical qualifications will be an advantage.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 8 Oct., 1954.

DEMONSTRATOR

Yeovil District of No. 4 (Bournemouth) Sub-Area. Salary N.J.C. Grade 1 (£400/£490 per annum). N.J.C. Conditions of Service.

Applicants should be women who are qualified to advise generally on the utilisation of electric domestic appliances, to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent Domestic Science qualification would be an advantage.

Applications on the standard form and in envelopes suitably endorsed must reach the Sub-Area Secretary, 1 Priory Rd, Bournemouth, not later than 1 Oct., 1954.

The successful candidates for the above appointments will be required to contribute to the B.E.A. and Area Boards' Superannuation Scheme, if eligible. (N 166)

BRITISH ELECTRICITY AUTHORITY
Southern Division

S/13.566

APPLICATIONS are invited for the following position:

STATION SUPERINTENDENT,
MARCHWOOD GENERATING STATION
(480 MW when completed).

Applicants should have received a thorough technical and practical training followed by wide experience in the operation and maintenance of generating station plant and have also held a position of responsibility involving the control of technical and administrative staffs. Preference will be given to corporate members of one of the senior professional engineering institutions, or those holding similar qualifications.

Salary N.J.M., Grade 3, £1,450/£1,600.

Special application forms, obtainable from P. D. A. Oliver, Divisional Secretary, High St, Portsmouth, should be returned not later than 8 Oct., 1954.

JC/NMH/65
9 Sept., 54. (N 147)

YORKSHIRE ELECTRICITY BOARD

No. 2 (Huddersfield) Sub-Area

Halifax District

DISTRICT SENIOR COMMERCIAL ASSISTANT (TODMORDEN)

THE successful applicant will be required to act, under the supervision of the Halifax District Commercial Engineer, as Local Manager at Todmorden. Candidates should be widely experienced in Commercial matters, control of Service Centres and in Public Relations. Clerical and administrative experience will be an advantage.

Salary—N.J.C. Grade 6, £730/£805 per annum.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield, not later than 30 Sept., 1954.

No. 5 (Wakefield) Sub-Area

Castleford District

THIRD ASSISTANT DISTRICT ENGINEER

Applicants must have had a sound practical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Applicants should hold a current driving licence and must be prepared to reside in the district and undertake standby duties.

Preference will be given to those who are Corporate Members of the Institution of Electrical Engineers or who hold equivalent qualifications.

Salary—N.J.B. Class F, Grade 9, £607/£629 per annum.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 5 (Wakefield), Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 30 Sept., 1954.

No. 6 (Hull) Sub-Area

DEMONSTRATOR

Applicants must have a two years' full time course in domestic subjects at a recognised Training College and possession of the E.A.W. Certificate will be an advantage. The successful candidate will normally be located at Hull, but may be required to work throughout the Sub-Area if occasion demands.

Salary—N.J.C. Grade 1, £400/£490 per annum.

Applications, giving full details of age, qualifications and experience, together with names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Hull, not later than 30 Sept., 1954. (N 133)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

SECOND ASSISTANT ENGINEER (Commercial) Southern Sub-Area Headquarters. N.J.B. G.7 (£729/£758 p.a.). Candidates (preferably qualified to H.N.C. standard) should be able to advise industrial and commercial consumers and have sound knowledge of tariff principles. Knowledge of street lighting and space heating will be an advantage.

Applications stating age, qualifications and experience should reach the Board at High St, Galashiels, within 14 days. (N 131)

BRITISH ELECTRICITY AUTHORITY

South Western Division

TECHNICAL STAFF VACANCIES

(*a*) ASSISTANT SHIFT CHARGE ENGINEER—Plymouth "B" Generating Station, N.J.B. "G" 9, £641/£667.

(*b*) ASSISTANT SHIFT CHARGE ENGINEER—Newton Abbot Generating Station, N.J.B. "F" 9, £607/£629.

Superannuation.

Applicants should have had a sound technical training and practical experience in a modern generating station.

Applications clearly indicating for which generating station, on Form A.E.6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 30 Sept., 1954. (N 132)

GOLD COAST LOCAL CIVIL SERVICE

SENIOR ELECTRICAL ENGINEER
ELECTRICITY DEPARTMENT, GOLD COAST

A VACANCY exists for a Senior Electrical Engineer in the Local Civil Service of the Gold Coast.

Duties are to take charge, under the Chief Electrical Engineer, of the operation and maintenance of electricity supplies at voltages up to 11,000 V. Appointment is on contract for 2 tours in the salary range £2,190/£2,310 per annum. A gratuity of £37. 10s. is payable for each completed 3 months' satisfactory service.

Free first-class passages are provided for the officer, his wife, and up to 3 children under 13 years of age. Government quarters, if available, are provided at a rental of £120 per annum. Leave is granted at the rate of 7 days for each completed month of resident service after a tour of 18-24 months.

Candidates must be A.M.I.E.E. and have had at least 10 years' experience since passing or becoming exempt from sections A and B of the Institution's examination. They should have been regularly trained as electrical engineers and have had a wide subsequent experience with an electricity supply authority in the construction and maintenance of E.H.T. and L.T. underground and overhead distribution systems and consumers' installations. A knowledge of compression ignition engines is desirable.

Apply in writing to the Director of Recruitment, Colonial Office, Great Smith St, London, S.W.1, giving briefly age, qualifications and experience. Mention the reference number (CDE 145/13/04/D10). (N 144)

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Lanarkshire Sub-Area

(1) APPOINTMENT OF GENERAL ASSISTANT ENGINEER (SUB-AREA PLANNING AND DEVELOPMENT DEPARTMENT)

(2) APPOINTMENT OF GENERAL ASSISTANT ENGINEER (SUB-AREA OPERATION AND MAINTENANCE DEPARTMENT)

APPLICATIONS are invited for the above appointments. Candidates should preferably be Graduates of the Institution of Electrical Engineers or hold equivalent qualifications.

The Salary and Conditions of Service for each appointment will be in accordance with the National Joint Board's Agreement, Schedule "A." The present Classification and Grading for each appointment is stated below.

The successful candidates for the above appointments will require to reside within a reasonable distance of the Sub-Area Offices at Hamilton.

(1) APPOINTMENT OF GENERAL ASSISTANT ENGINEER (SUB-AREA PLANNING AND DEVELOPMENT DEPARTMENT)

Applicants for this appointment should have had a sound engineering training also a knowledge of Short Circuit Calculations, "Load Flow" Diagrams and "Voltage Drop" Calculations, together with some experience in the design and layout of H.V. and L.V. Underground and Overhead Distribution Systems.

The present Classification and Grading for this appointment is K.13, Salary £583/£605 per annum, which will be subject to the statutory deductions including superannuation.

(2) APPOINTMENT OF GENERAL ASSISTANT ENGINEER (SUB-AREA OPERATION AND MAINTENANCE DEPARTMENT)

Applicants for this appointment should have had a sound engineering training also a knowledge of Short Circuit Calculations, "Load Flow" Diagrams and "Voltage Drop" Calculations, together with some experience in the operation and maintenance of H.V. and L.V. Distribution Systems.

The present Classification and Grading for this appointment is K.13, Salary £583/£605 per annum, which will be subject to the statutory deductions including superannuation.

Application Forms for the above appointments, which may be obtained from the undersigned, or any other Sub-Area Manager, should be returned to this office within 14 days of the date of this notice.

DUGALD SMITH,
Manager.

137 Almada St,
Hamilton. (N 140)

BRITISH ELECTRICITY AUTHORITY

Midlands Division

SECOND ASSISTANT ENGINEER (Mechanical) is required in the Generation (Construction) Department at Divisional Headquarters, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule "C," Grade 2, of the Agreement, commencing in range £834 to £970, and ultimately rising to £1,053 per annum.

Applicants should have had a recognised training in mechanical engineering, and a thorough experience in the design and installation of mechanical equipment for power stations, including the preparation of specifications. Applicants should preferably be corporate members of the Institution of Mechanical Engineers.

Apply, quoting Vacancy No. 760MD on form AE6, available from the Establishments Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 2 Oct., 1954. (N 155)

ELECTRIC POWER UTILITY COMPANIES IN BRAZIL

COMPTROLLER

APPLICATIONS are invited from qualified accountants between the ages of 35 and 45 years for the post of Comptroller and General Assistant to the Financial Director of a group of State-controlled utility companies in Brazil. (Capital, approx. £6½ million; the initial programme is the installation of 200,000 kW generating plants of which some are in operation and others with their construction already well advanced.)

Candidates should have had at least 5 years' full time employment in an electric power utility with a minimum of 2 years' experience at a level comparable with at least that of an assistant chief accountant. Knowledge of punch card accounting an advantage though not essential.

The post requires: immediate supervision over the application and control of substantial loans received from the World Bank and Local Federal and State Authorities; familiarisation within a reasonable time with local tax legislation and the general accounting, which would eventually be placed under the successful applicant's responsibility. Knowledge of budgeting, commitment appropriations and foreign financing, a distinct advantage.

Three years' contract, renewable, with 3½ months' leave on full pay and return first-class passages for the employee and his family. Salary, part payable in U.S. dollars or £ sterling and the balance in cruzeiros.

Write, enclosing references and recent photograph with full particulars of: past experience, whether single or married, number of children under 21 years, knowledge of Spanish or Portuguese, if any, and salary required, to Barton, Mayhew and Co., Alderman's House, Bishopsgate, London, E.C.2. (N 120)

BRITISH ELECTRICITY AUTHORITY

Yorkshire Division

APPLICATIONS are invited for the appointment as SECOND ASSISTANT ENGINEER (Mechanical) in the Generation Construction Department, Rotherham.

The commencing salary will be within the salary range £834/£1,083 per annum Grade 2, Class AX/EX, N.J.B. Agreement (Schedule C), according to qualifications and experience.

Applicants should perferably be Corporate Members of the Institute of Mechanical Engineers or possess equivalent qualifications. They should be experienced in Power Station design and construction, with particular reference to turbo-alternators, boilers, coal and ash handling plant, high pressure steam and water piping, and other ancillary work, and should also have knowledge of the preparation of schemes, specifications and estimates.

Application forms may be obtained from the Divisional Secretary (Establishments), British Electricity Hse, St. Mary's Rd, Leeds 7, and should be returned within 14 days of the appearance of this advertisement.

G. A. VOWLES,
Divisional Controller.
(N 151)

SOUTH WESTERN ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER—EXETER

SALARY N.J.B. Class E, Grade 4—£803 to £834 p.a.

Duties include responsibility to the District Manager for all commercial negotiations with consumers including the technical aspects; supervision of Service Centres and outside sales staff; control of installation contracting and consumers' service; organisation of exhibitions, demonstrations and publicity; preparation of revenue estimates. Candidates should possess extensive knowledge of, and have had wide experience in the commercial side of the industry and be capable of promoting a progressive commercial development policy. Corporate membership of the I.E.E. is desirable.

Application forms obtainable from the Sub-Area Manager, 57 Paul St, Exeter, should be returned by 2 Oct., 1954.

SECOND ASSISTANT ENGINEER (PLANNING AND DEVELOPMENT)—BRISTOL

Salary N.J.B. Class J, Grade 7—£817 to £852 p.a.

Candidates should have wide experience in the design, construction and operation of urban and rural systems comprising substations, underground and overhead mains at voltages up to and including 33 kV. They should be capable of preparing distribution schemes and estimates and negotiating with consumers, local authorities and manufacturers of equipment—corporate membership of the I.E.E. is desirable.

Application forms obtainable from the Sub-Area Manager, Electricity Hse, Bristol 1, should be returned by 2 Oct., 1954.

SURVEYOR—AREA BOARD HEADQUARTERS—BRISTOL

Salary N.J.B. Schedule D, Grade 6—£433 to £567 p.a.

Applicants should have experience in practical surveying, employing a theodolite and dumpy level, preferably on overhead line work in the electricity industry. The successful candidate will be required to travel extensively throughout the Board's area, for which allowances are payable.

Application forms from Assistant Secretary (Establishments) Electricity Hse, Bristol 1, to be returned by 2 Oct., 1954. (N 146)

THE NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT OF THIRD ASSISTANT ENGINEER—(MAINS), CONSTRUCTION SECTION, CHIEF ENGINEER'S DEPARTMENT, AREA BOARD HEADQUARTERS, MANCHESTER

APPLICANTS should have had experience in the design, erection and/or laying of M.V. and H.V. Overhead lines and Underground cables up to and including 33 kV, together with experience in field survey.

A detailed knowledge of 33 kV cable joint design will be considered an advantage. Candidates should also have experience in the preparation of technical reports.

Salary Scale: £649/£790 rising subsequently to £883 p.a. Class AX/EX, Grade 5, N.J.B. Conditions.

Applications to Establishment Officer, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 25 Sept., 1954.

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEER, SOUTH-WEST FYLDE DISTRICT, BLACKPOOL

Duties will include the operation, maintenance and construction of underground and overhead mains, substations and transformers and general mains work including standby duty. Applicants should state their experience in high voltage mains work. Possession of a Higher National Certificate in Electrical Engineering will be an advantage.

Salary Scale: £607/£629 p.a. Grade F.9, N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 4 Sub-Area, The North Western Electricity Board, 40/41 Lune St, Preston, by 25 Sept., 1954.

APPOINTMENT OF SECOND ASSISTANT DISTRICT COMMERCIAL ENGINEER, ROSSENDALE DISTRICT

Duties will include control and supervision of industrial and domestic contract wiring, preparation of specifications and installation, repair and maintenance of

continued in next column

continued from previous column

appliances on consumers' premises. Preference given to applicants who are Associate Members of the Institution of Electrical Engineers.

Salary Scale: £649/£681 p.a. Grade E.7, N.J.B. Conditions.

Applications to the Sub-Area Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 25 Sept., 1954.

APPOINTMENT OF SECOND ASSISTANT ENGINEER (SYSTEM PLANNING) SUB-AREA ENGINEER'S DEPARTMENT, CASTLE GREEN, KENDAL

The successful applicant will be required to assist in System Planning design including the specification and ordering of Switchgear and Protective Equipment and will be responsible for investigations into system load flows, fault levels and relay settings. Applicants should preferably have had some experience in cable laying, overhead line erection, and in the design and construction of 11 kV and 33 kV substations. Preference given to applicants who hold Corporate Membership of the Institution of Electrical Engineers.

Salary Scale: £817/£852 p.a. Grade J.7, N.J.B. Conditions.

APPOINTMENT OF FIRST ASSISTANT DISTRICT ENGINEER, WHITEHAVEN DISTRICT

Duties will be to assist the District Engineer in the control, construction, operation and maintenance of the H.V. and M.V. networks throughout the District. Experience in Overhead Distribution systems is essential. Preference given to applicants who hold Corporate Membership of the Institution of Electrical Engineers.

Salary Scale: £850/£887 p.a. Grade F.4, N.J.B. Conditions.

APPOINTMENT OF THIRD ASSISTANT DISTRICT ENGINEERS, PENRITH DISTRICT

Applicants should be capable of preparing schemes and estimates for O/H and U/G construction up to 11 kV by both direct and contract labour. A knowledge of the usual Statutory and Planning requirements is essential. Possession of the H.N.C. in Electrical Engineering would be an advantage.

Salary Scale: £561/£578 p.a. Grade D.9, N.J.B. Conditions.

Applications for the above appointments to Sub-Area Manager, No. 6 Sub-Area, The North Western Electricity Board, Castle Green, Kendal, by 25 Sept., 1954. (N 130)

SOUTH EASTERN ELECTRICITY BOARD

SHOWROOM ASSISTANT (Male or Female). Crawley District. Salary—Male £250 p.a. at age 20 to £395 p.a. at age 26, rising subject to satisfactory service to £470 p.a. Female £203 p.a. at age 20 to £320 p.a. at age 26, rising subject to satisfactory service to £380 p.a. Applicants must have electrical showroom experience and be able to deal with tariffs, consumers' enquiries, have knowledge of electrical apparatus and ability and initiative to promote sales.

Applications, naming 2 referees to F. A. Avery, A.I.E.E., Crawley District, Manager, SEEBoard, 55 High St, Crawley, by 29 Sept., 1954.

A. L. BURNELL,
Secretary.
(N 145)

MIDLANDS ELECTRICITY BOARD

DEMONSTRATOR (Female) required in the Banbury District. Applicants must have had good education and should have a certificate of a recognised Domestic Training College and/or the E.A.W. Certificate. Duties include lecture demonstrations in Service Centres and on consumers' premises, and advising consumers on the selection and use of electrical appliances.

Salary £400/£490 per annum (N.J.C. Grade 1). Superannuable.

Applications, stating age, education, qualifications, training and experience should be forwarded, within fourteen days to Sub-Area Manager, Midlands Electricity Board, Whittington, Worcester.

A. STEPHENS,
Secretary.
(N 149)

RADIO MECHANIC

required for the Bermuda Police Force in the rank of Constable for a tour of 5½ years with possibility of permanency. Salary scale (including present temporary allowance of 10% of salary) £715 rising to £825 a year. Free passages and uniform. No income tax. Candidates must be unmarried, between 21 and 28 years of age, of sound physique and good education. They must be familiar with Signal Generator, Valve Tester, Anometer and Battery Charger Equipment and also VHF Equipment similar to Pye Series PTC 704 (Fixed Unit) and Pye Series PTC 115 (Mobile Units). Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M1/36551/EE. (N 106)

BRITISH ELECTRICITY AUTHORITY
Eastern Division

APPLICATIONS are invited for the following appointments:

(a) STATION CLERK—TILBURY GENERATING STATION

Salary: Grade 5 of the N.J.C. Salary Agreement, £670 by £20—£730 per annum, plus London Weighting.

(b) STATION CLERK—GOLDRINGTON GENERATING STATION, BEDFORD

Salary: Grade 4 of the N.J.C. Salary Agreement, £605 by £20—£655 per annum.

Both Generating Stations are at present under construction and when completed will be of 360 MW and 180 MW capacity respectively.

Applicants should have had wide experience in administrative and accounting duties at a Generating Station, knowledge of mechanised accounting systems and a recognised qualification (e.g. Cost and Works Accountants), would be an advantage.

Applications stating age, qualifications, experience and present position should be sent to the Controller, Northmet House, Southgate, N.14, not later than 4 Oct., 1954.

W. N. C. CLINCH,
Controller.
(N 135)

LONDON ELECTRICITY BOARD

SENIOR DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Design and Planning Branch of the Northern Sub-Area at Aldersgate, London, E.C.1.

Applicants should have had training and experience in building construction and the design of steelwork and reinforced concrete structures, and be capable of preparing drawings and making calculations for the alteration of existing premises and the conversion of basements into substations and transformer chambers. Experience in the lay-out of electrical equipment up to 11 kV, whilst not essential, would be an advantage.

The post is graded under Schedule "D" of the National Joint Board agreement as Grade 5—£595. 7s./£704. 11s. per annum, inclusive of London Allowance.

Application forms obtainable from Personnel Officer, 46 New Broad St, E.C.2, to be returned completed within ten days of the publication of this advertisement. Please enclose addressed envelope and quote ref.: V/1692/T on all correspondence. (N 121)

BRITISH ELECTRICITY AUTHORITY
South-Eastern Division

ASSISTANT ENGINEER (Projects) Brighton "A" and "B" Power Stations. The position requires initiative coupled with an analytical and enquiring mind and the successful applicant will be engaged on projects designed to improve the efficiency of the Power Station in all aspects. He will be responsible for the initiation and carrying out of such schemes. A sound knowledge of modern Power Station practice and the possession of Higher National Certificate or equivalent qualification would be desirable. N.J.B. conditions of service, Class L, Grade 9, £811 per annum. Applications giving details of education, present position, experience, etc., should be received by the Station Superintendent, Brighton Power Station, Portslade-by-Sea, Sussex, not later than 25 Sept. (N 141)

IMPERIAL COLLEGE

APPLICATIONS are invited for LECTURER in Electrical Engineering. Salary scale £600 x £50—£900 x £50—£1,150. F.S.S.U. and Family Allowances. Candidates should possess a good honours degree in electrical engineering and preferably have completed a Graduate Apprenticeship. Initial salary, according to experience and qualifications, will be at the lower end of the scale.

Applications, stating age, academic qualifications and experience, together with the names of two referees, should reach the Head of the Electrical Engineering Department, City and Guilds College, S.W.7, not later than 1 Oct., 1954. (N 58)

NORTH EASTERN ELECTRICITY BOARD
York Sub-Area

APPLICATIONS are invited for the appointment of SECOND ASSISTANT DISTRICT ENGINEER, Whitby District.

Salary Schedule "A," Class "B." Grade 7, £559/£586. N.J.B. Conditions of Service.

Applications stating age, qualifications and experience should be forwarded to the Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle-upon-Tyne, within ten days of the appearance of this advertisement. (N 153)

BRITISH ELECTRICITY AUTHORITY
North West, Merseyside and N. Wales Division

VACANCY No. 166/54T — FIRST ASSISTANT STATION CHEMIST, Ribble Generating Station, Preston. Salary £680/£706 (H.9). Closing date 6 Oct.

Vacancy No. 167/54T—STATION SHIFT CONTROL ENGINEER, Barrow. Salary £531/£547 (D.10).

Vacancy No. 168/54T—STATION SHIFT CONTROL ENGINEER, Padiham, near Burnley. Salary £555/£569 (E.10).

Vacancy No. 169/54T—SHIFT CHARGE ENGINEER, Wigan. Salary £633/£643 (D.7).

Closing date 25 Sept.

Applications quoting vacancy No. to Controller, British Electricity House, 825 Wilmslow Rd, Manchester 20. (N 137)

A LARGE industrial undertaking in the North Western area, with world-wide associations, invites applications from HONOURS GRADUATES IN ELECTRICAL ENGINEERING who have completed full-time National Service obligations to fill a vacancy in a central technical department. The upper age limit for the post is 28. Previous industrial experience, although desirable, is not essential. The successful candidate will be trained in matters relating to the manufacture, design, development and application of the Company's products and will also be given an opportunity of familiarising himself with relevant matters connected with the Commercial and Sales side of the organisation. The initial training and subsequent experience will be designed to give the candidate every opportunity of advancement to an executive post. The commencing salary will be within the range £600 to £750 p.a., dependent upon the qualifications and experience of the candidate appointed. A non-contributory pension scheme is operated by the Company. Please write, giving full particulars, which will be treated in strictest confidence to—Box No. 3829, Electrical Times. (N 126)

ALKALINE BATTERIES LTD., of Redditch, are the largest makers in the Empire of Alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its Technical Sales and Development Sections for Graduate ELECTRICAL ENGINEERS, not over 30 years of age, or for men nearing the end of their Degree Course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed to Commercial Manager, Alkaline Batteries Ltd., Union St, Redditch. (N 1)

AN opportunity occurs in progressive manufacturing concern in London area for ENGINEER aged 25/35 with electrical or physicist degree, on development and research work on high frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box No. 3811, Electrical Times. (N 64)

BRITISH ELECTRICITY AUTHORITY HEADQUARTERS, LONDON, require a SECOND ASSISTANT ENGINEER in the Operational Assessment and Analyses Sub-Branch of the Generation Operation Branch. Duties will be concerned with operational research and will involve the detailed examination and analyses of the performance of generating plant and the study of methods of improving efficiency and availability. Candidates should preferably hold a University Degree or the equivalent and be Corporate Members of either the I.E.E. or I.Mech.E. Some years practical experience in power stations, preferably including maintenance work is desirable.

Salary N.J.B. Grade 3, £840/£1,209 inclusive.

Applications stating age, qualifications, experience and present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley Street, London, W.1, by 30 Sept., 1954. Quote Ref. ET/523. (N 159)

BRITISH ELECTRICITY AUTHORITY, Transmission Design Branch, Headquarters, London, require a THIRD ASSISTANT ENGINEER (Protective Gear) in the Plant and Equipment Design Sub-Branch. Candidates should have all-round experience in the theory and practice of modern types of protective gear for large high voltage systems, a general knowledge of electrical plant characteristics and be accustomed to the preparation and interpretation of complex wiring diagrams. Engineering and education qualifications equivalent to A.M.I.E.E. standard are essential. Salary N.J.B. Grade 4, £753/£981 p.a. inclusive. Applications stating age, qualifications, experience, present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 30 Sept., 1954. Quote Ref. ET/519. (N 128)

BRITISH ELECTRICITY AUTHORITY, Generation Design Branch, Headquarters, London, require a PRINCIPAL ASSISTANT ENGINEER in the Station Development Sub-Branch, which is mainly concerned with the planning, siting and negotiation of facilities and consents for new and extended power stations and for the launching of these projects within the Authority's organisation. Candidates should possess an honours degree or be Corporate Members of either the I.Mech.E. or the I.E.E., and have sound experience of power station design. A knowledge of the selection of sites for new power stations and experience of supervising negotiations would be an advantage. Salary within N.J.M. Scale 4, £1,650/£1,800 inclusive. Application forms from D. Moffat, Director of Establishments, Winsley St, London, W.1, to be completed and returned by 28 Sept., 1954. Quote Ref. ET/518. (N 112)

CHARTERED ELECTRICAL ENGINEER

required by a large retail organisation of national repute, to advise the Chief Architect to whom he will be directly responsible, on the design, installation and general work concerning the lighting of shops. Previous experience of modern lighting design is essential and a knowledge of heating and ventilating would be an advantage. Age not over 40. Salary £1,500 or higher will be offered according to experience. The post is pensionable.

Applications, by letter only, giving full details of experience should be addressed to: The Secretary, The Professional Engineers Appointments Bureau, 9 Victoria St, Westminster, London, S.W.1. (N 160p)

Appointments are available with THE ENGLISH ELECTRIC COMPANY LIMITED, on important work covering Application Engineering on all classes of electrical equipment. These appointments are pensionable after a qualifying period and apprentice trained men with Higher National Certificate in Electrical or Mechanical Engineering or equivalent, and with previous experience on Application work are preferred.

Experience in the manufacturing or power supply industries or in the application or installation of electrical equipment in any branch of industry or engineering is an alternative qualification and professional engineers in these fields are also invited to apply.

A number of vacancies also exist for apprentice trained engineers seeking an opportunity of acquiring Application Engineering experience. Reply stating age, experience, qualifications and quoting Ref. S.A. 33D to Dept. C.P.S., 336/7 Strand, W.C.2. (N 51p)

BRITISH ELECTRICITY AUTHORITY require a THIRD ASSISTANT ENGINEER in the Research Sub-Department at Headquarters in London. Candidates should have at least three years' industrial experience and should preferably be Graduate Members of the I.E.E. or the I.Mech.E. The post demands a sound knowledge of the general principles underlying electricity supply techniques, rather than any specialised skill. Candidates should be interested in engineering development and have some mathematical ability and be mentally adaptable. There is unlikely to be much scope for experimental work, but familiarity with the aims and methods of research is desirable.

Salary N.J.B. Grade 4, £753/£981 inclusive.

Applications stating age, qualifications, experience, present position and salary should be forwarded to D. Moffat, Director of Establishments, Winsley St, London, W.1, by 4 Oct., 1954. Quote Ref. ET/517. (N 111)

CHIEF ENGINEER required to commence duty as early as possible and to control Drawing Office, Development and Design. Must have technical and practical experience of Switchgear up to 11 kV and preferably some knowledge of Motor Control Gear. He must be a Member or Associate Member of the Institution of Electrical Engineers. Good permanent and progressive position for the right man. Pension scheme in operation. Apply by letter, marked personal, giving full particulars of experience, salary required, to Managing Director, Erskine, Heap and Co., Ltd., Lancashire Switchgear Works, Manchester 7. (N 39)

CONSULTING Engineers require SENIOR AND JUNIOR ELECTRICAL ENGINEERS with experience of design, specification and supervision of electrical installations for all types of buildings. Apply in writing stating age, experience and salary required to Oscar Faber and Partners. 29 Queen Anne St, London, W.1. (N 168)

CONTRACTS ENGINEERS required for handling of switchgear tenders and contracts. Applications should state age, experience, qualifications and salary required and should be addressed to Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. (N 72)

CONSULTING Engineers require ELECTRICAL DESIGNER DRAUGHTSMAN, age twenty-four to thirty-five, experienced in all classes of lighting and power installations for hospitals, schools, industrial projects, preparation of contract and specifications, etc., good draughtsmanship essential. Reply to A. F. Myers and Partners, 147 Victoria St, London, S.W.1. (N 107)

A firm manufacturing medium voltage electrical distribution equipment and located on Merseyside, requires the following additional staff:

TECHNICIAN to translate customers' requirements into specifications for contracts and drawing office departments. H.N.C. in electrical engineering desirable together with practical distribution gear experience; salary £600/£650 p.a.

DESIGNER / DRAUGHTSMEN for design and development work, mainly mechanical but requiring a sound knowledge of basic electrical technology; salary £650/£750 p.a.

The posts are pensionable. Please apply, stating age, qualifications and experience to Box 2J, J.7459, A.K. Advg., 212a Shaftesbury Ave, London, W.C.2. (N 158p)

DRAUGHTSMEN. Several senior men required for Consulting Engineers Office. Work entails Generating Station plant, layout and design, including steam, water, coal and ash and other ancillary services, etc., with general mechanical design as applied thereto.

Applicants should have sound mechanical engineering background preferably up to H.N.C. standard. Previous Power Station experience an advantage but consideration will be given to suitable applicants with equivalent experience of mechanical plant layout. Five-day working week and pension scheme in operation. Suitable salaries for right men commensurate with age and experience.

Applications should be made in writing, giving full details of age, experience and salaries required to Merz and McLellan, Carliol Hse, Newcastle-upon-Tyne. (N 124)

DEVELOPMENT DESIGN DRAUGHTSMEN required for a small group engaged upon general engineering developments including special purpose automatic and semi-automatic machinery, metallurgical and chemical engineering processes and plant, combustion and electric furnaces, electrical power control and measuring equipment. Applicants must be Engineers with professional or academic qualifications and workshop apprenticeship, and preferably over 28 years of age. These vacancies are only for men with high ability and several years' experience of original design, and capable of supporting a programme of rapid capital expansion and long term development. Candidates should be able to produce recent references and sample designs if necessary. Apply: Personnel Manager, Carringtons Ltd., Bromsgrove. (N 79)

ELECTRICIAN required by London Electricity Board in Stoke Newington District of Northern Sub-Area. N.J.I.C. rates and conditions. 4s. 1d. p.h. Application forms form Personnel Officer, 46 New Broad St, E.C.2. Please enclose addressed envelope and quote ref.: M/3262/T. (N 169)

ELECTRICAL ENGINEER required (aged 30-40, preferably Chartered), to assume leading position — commanding equivalent £1,000 p.a. to start—in Design Office of London Company. Applicants must be fully conversant with low and medium voltage automatic contactor gear, motors, relay systems, and methods of temperature control. Previous D.O. experience and a thorough knowledge of wiring systems applied to precision machinery is essential. Write in first instance: Personnel Manager, Molins Machine Co., Ltd., Evelyn St, London, S.E.8. (N 7)

Assistant Electrical Engineer

required by London Consulting Engineers for preparation of drawings and specifications for electrical installations in all types of buildings. Write giving full details of experience, age and salary required to—Box ET 586, LPE, 55 St. Martin's Lane, W.C.2. (N 122p)

ELECTRICAL FITTERS are required by the British Electricity Authority at their Nottingham Transmission Section. The nature of the work involved includes the overhaul of 132,000 Volt Transformers and switchgear at Transforming Stations within the Nottingham Section. Previous experience of H.V. apparatus would be an advantage. Rate of pay 45d. per hour, 44-hour week. Terms and conditions of service in accordance with N.J.I.C. Agreement. Applications in writing to Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham. Please quote Vacancy No. 109/54/ET. (N 157)

ELECTRICAL (machine-tool) ENGINEER conversant with the latest machine-tool practice is required for electrical development work, the preparation of specifications, wiring diagrams, etc., in a progressive west-Midland factory. Applicants should possess an H.N.C. or equivalent qualification and have initiative and drive. Salary £700/£800 p.a.; age 26/35, Pension scheme. Please apply, giving full details of training and experience to Box 2J, J.7452, A.K. Advg., 212a Shaftesbury Ave, London, W.C.2. (N 170)

ELECTRICAL FOREMAN required for maintenance of high voltage switchgear, motors, cables, control gear, etc. Commencing salary £505 per annum (range £505/£20/£665). Contributory pension scheme. Apply in writing, stating age and experience to Chief Engineer, The Colne Valley Water Company, Aldenham Rd, Watford, Herts. (N 167)

ELECTRICIAN FITTER wanted by East London firm. Man with tools and initiative. Able to work without supervision on plant maintenance and repairs. North country training an advantage. Apply—Box No. 3807, Electrical Times. (N 46)

ELECTRICAL DESIGNER-DRAUGHTSMAN required with experience in the design of Electrical Control Panels and Control Circuits for Automatic Machinery. Good opportunity, good prospects and interesting work for the right man. Pension Fund Scheme facilities. Staff Canteen, 5-day week. Please apply stating age and experience to Projectile and Engineering Co., Ltd., Acre St, Battersea, S.W.8. (N 110)

ESTIMATING (SALES) CLERK (Male), aged 21/30 required. Good standard in maths and general education essential. Progressive, superannuation, sports. Permanency for right man. Apply Personnel Officer, Southern United Telephone Cables Ltd., Dagenham Dock. (N 63)

FERRANTI LTD. (Meter Dept.) have a few vacancies in their Experimental Dept., for men of approximately graduate status in Electrical Engineering or Physics.

A particular interest in the theory of electrical measurements is desirable. The work of the department covers a variety of interesting electrical and electro-mechanical problems arising in the development of all types of electricity meters.

Permanent staff appointments with pension benefits.

Application forms from Mr T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote reference MDE. (N 55)

JOHNSON AND PHILLIPS LTD., have vacancies in their Transformer Department for TRANSFORMER DRAUGHTSMEN having experience in all sizes up to 1,000 kVA. In addition vacancies exist for men having experience in sizes 1,000 kVA to 30,000 kVA and the higher voltages.

Applicants should state age, training and experience, together with salary required, to Employment Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7. (N 38)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2.

The English Electric Co., Ltd.

invite applications for the following positions in their MECHANICAL AND PRODUCTION ENGINEERING DEPARTMENTS at LUTON and STEVENAGE:

(1) SENIOR ELECTRICAL DESIGN ENGINEERS with H.N.C. or equivalent experience on machine tools, fighting vehicle or aircraft installations are required to lead small sections on complete design installations including the preparation of all information required for works production.

(2) SENIOR ELECTRICAL DEVELOPMENT ENGINEER with H.N.C. or equivalent experience on development of electrical equipment is required to work in conjunction with Mechanical Engineers on equipment being used in prototype and field installations.

(3) SENIOR ELECTRICAL EXPERIMENTAL ENGINEER with H.N.C. or equivalent experience is required to take charge of a small laboratory for investigating electrical circuits and equipment prior to final design being completed, together with testing of final designs and modifications.

(4) ELECTRICAL LIAISON ENGINEER with H.N.C. or equivalent experience is required to investigate electrical problems with equipment suppliers and field installation engineers.

(5) ELECTRICAL DESIGN ENGINEERS with O.N.C. or equivalent experience are required for detail design from basic specifications.

(6) ELECTRICAL DRAUGHTSMEN required for general design, productions and development work.

(7) SENIOR JIG AND TOOL DRAUGHTSMEN with O.N.C. or equivalent backed by tool room and drawing office experience.

These are permanent and progressive posts in an expanding industry. Successful applicants from the Greater London Area can be assisted with housing. Applications to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 1360. (N 171p)

JUNIOR ENGINEERS required by British Electricity Authority on operating staff of the power stations in North West England, particularly the Manchester, Salford and Wigan areas. Applicants should have completed a recognised form of practical training and have a theoretical attainment of at least Ordinary National Certificate in Electrical or Mechanical Engineering. Fundamental knowledge of electrotechnology is essential. Commencing salary in range £402/£545. Good promotion prospects. Pension scheme.

Applications to Controller, British Electricity Hse, 825 Wilmslow Rd, Manchester 20, quoting Vacancy No. 163/54/T. (N 138)

KEEN YOUNG SALES ENGINEER required as Midlands Representative by manufacturers of all forms industrial MV switchboards, cubicles, control panels, substation switchboards, feeder pillars, etc., with full range heavy duty combination fused switches to 800 amps and full industrial and domestic range of fusegear. Give details of experience in confidence to Managing Director, Dennis Switchgear, Fleming Rd, Speke, Liverpool. (N 139)

MECHANICAL DRAUGHTSMAN required for factory in West Midlands. Permanent and pensionable post, attractive working conditions. Maximum salary approximately £730 p.a. Experience of design of malleable castings an advantage. Apply, giving particulars of age, qualifications and experience, to—Box No. 3827, Electrical Times. (N 125)

NETTLE ACCESSORIES LTD., Harper Rd, Wythenshawe, Manchester, require REPRESENTATIVE for London, South of the Thames and London South Eastern Electricity Board area. Car owner preferred but not essential. Considerable scope. Staff Pension Scheme operative. Apply in strict confidence, giving details of experience, salary required, etc., to the Sales Manager. (N 108)

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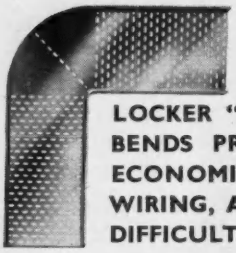

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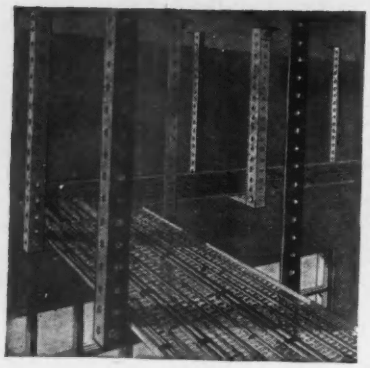

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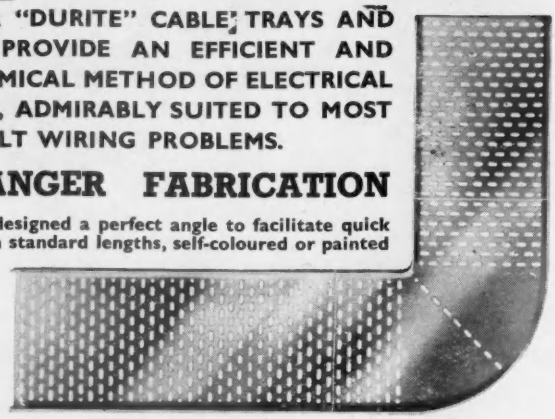

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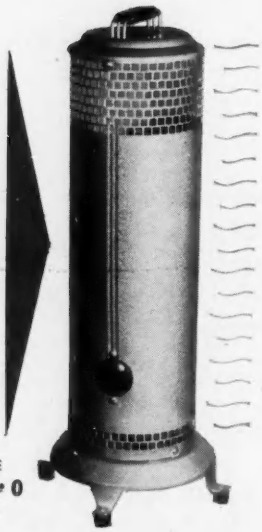

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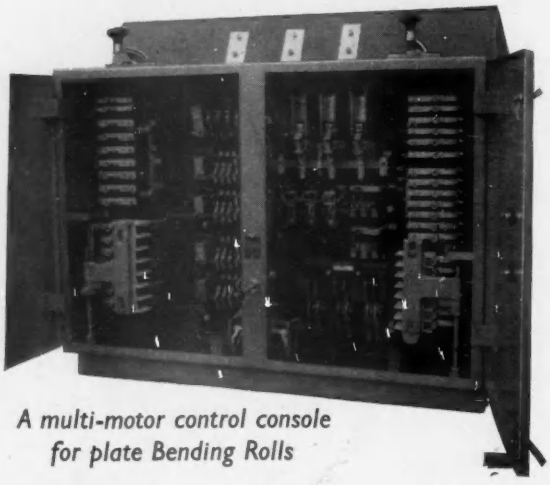

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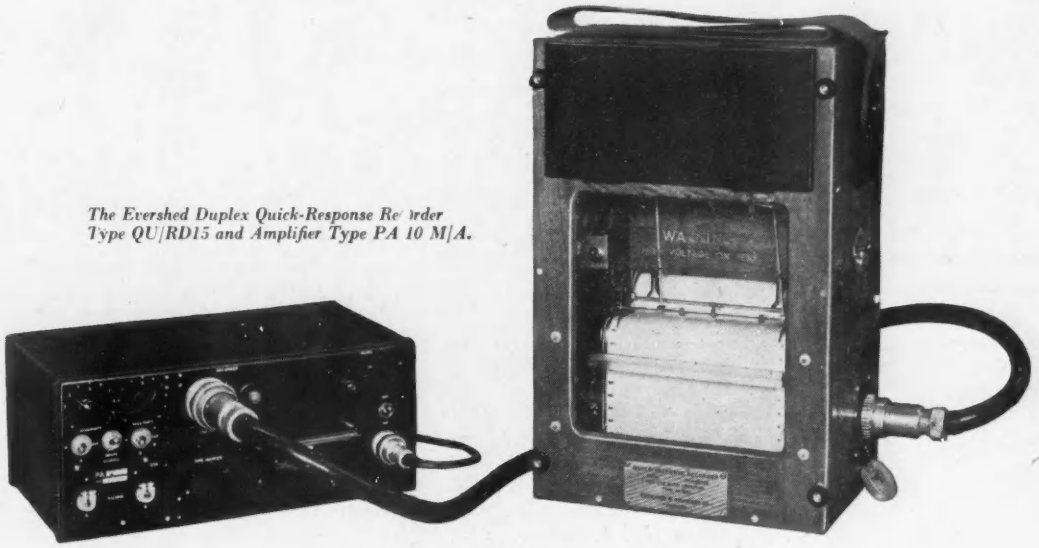

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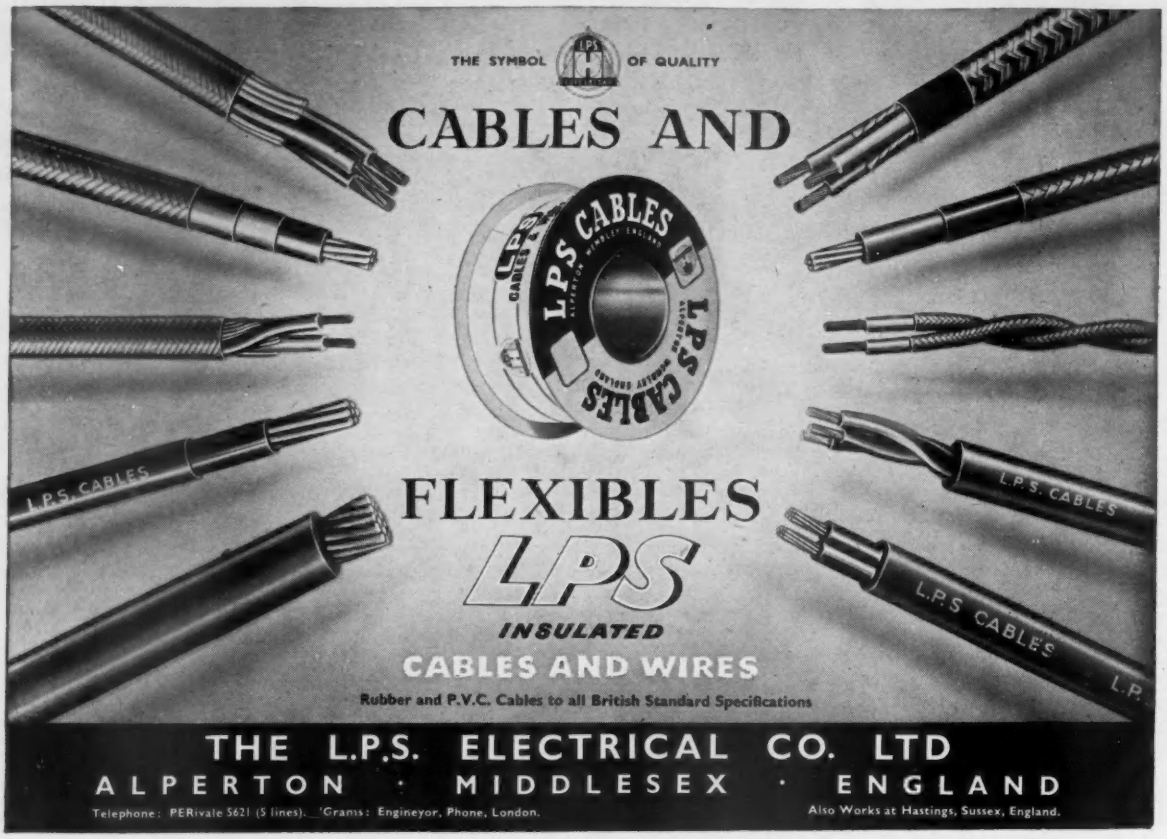
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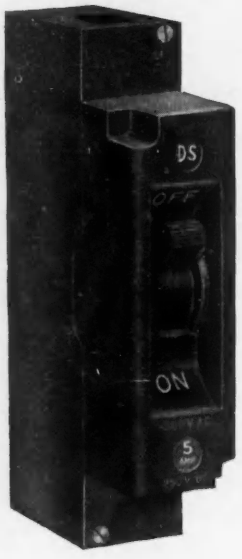

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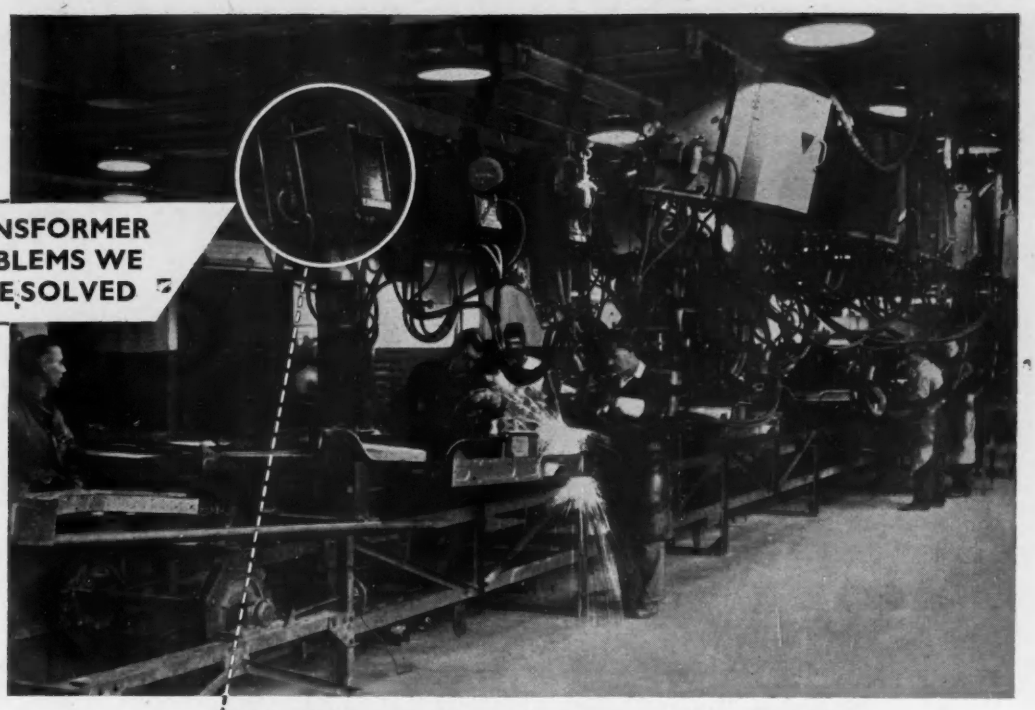

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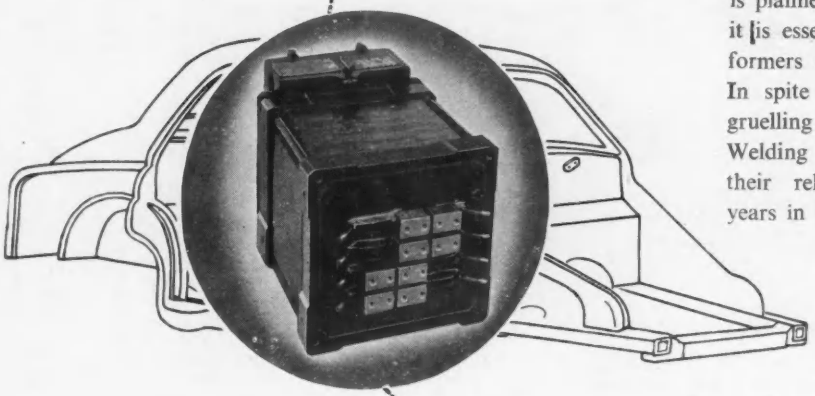

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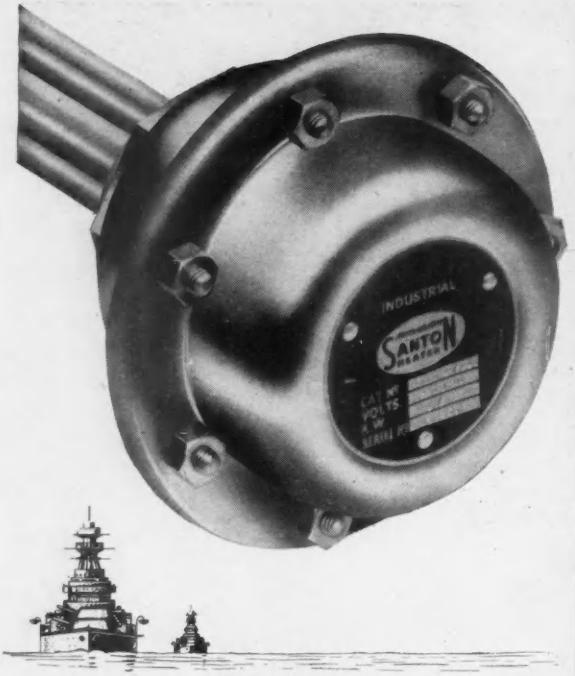

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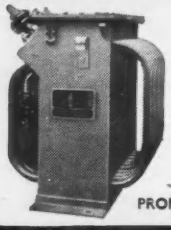

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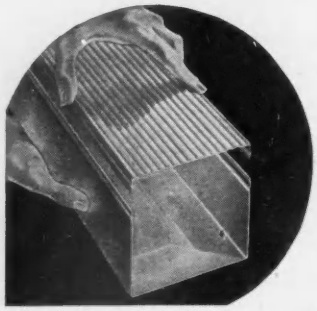

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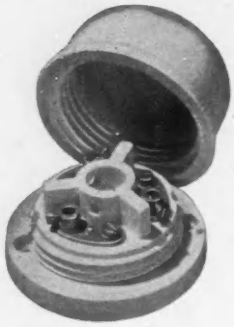

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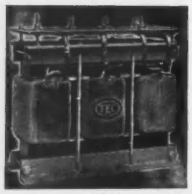

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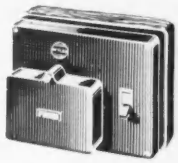

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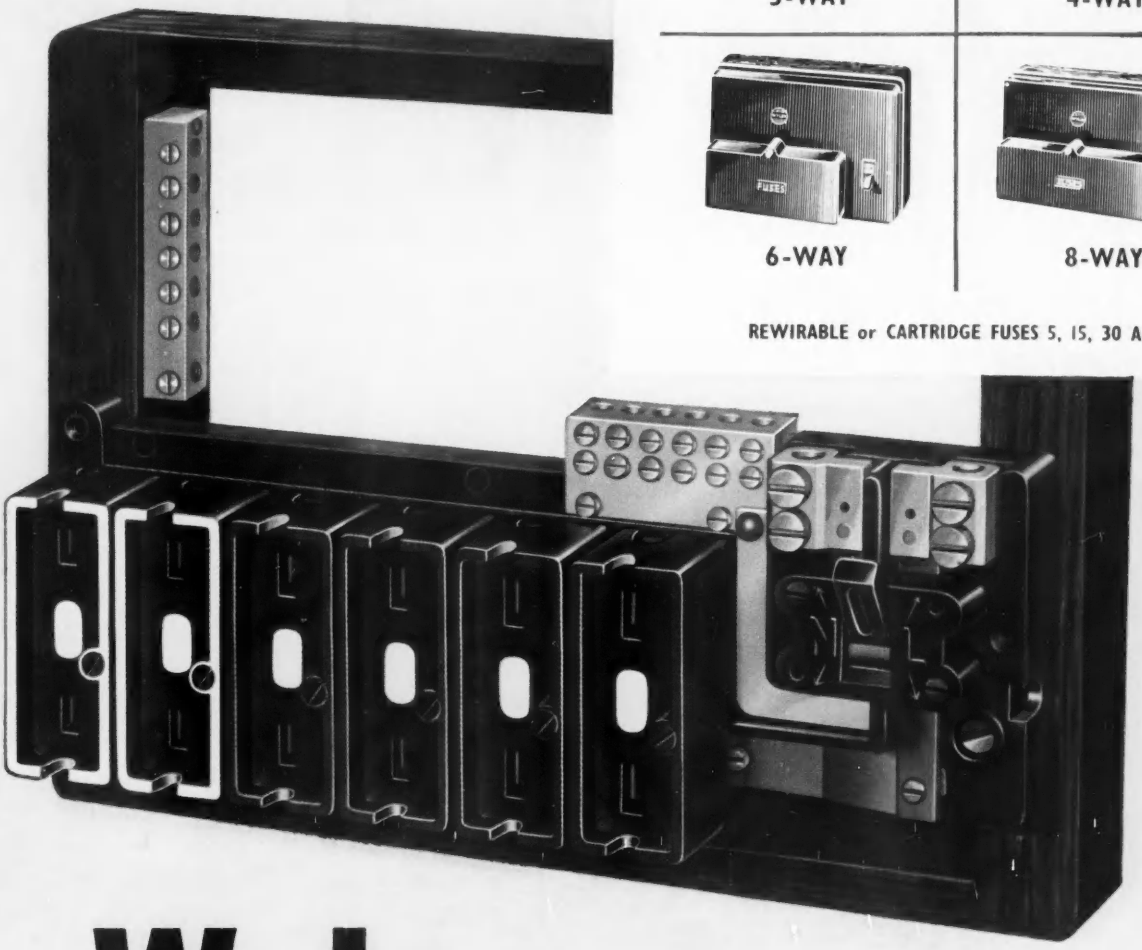

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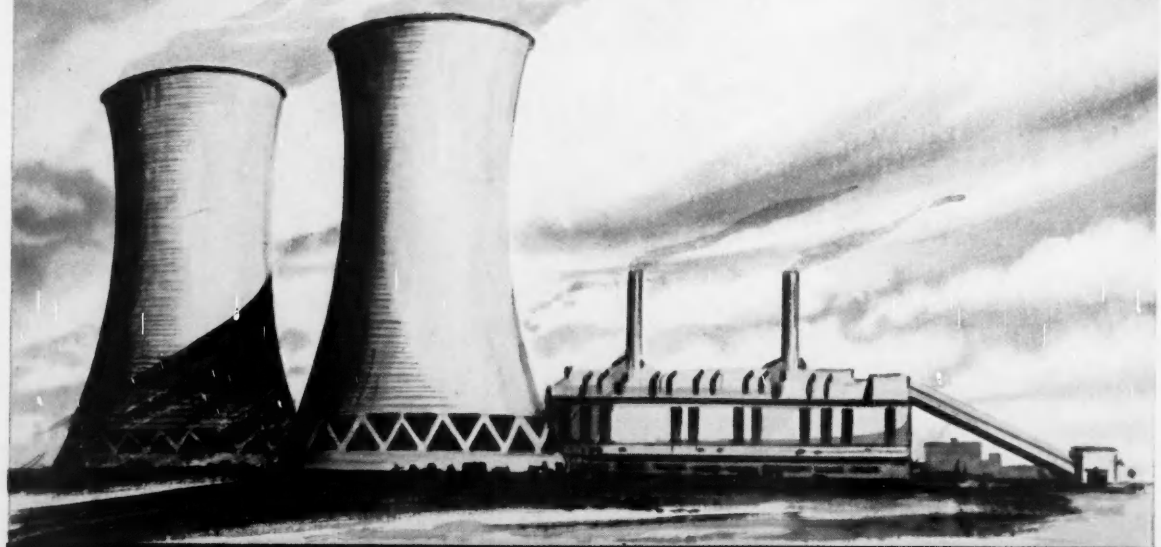

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